WATER WORKS & SEWERAGE

A GILLETTE ABP ABC PUBLICATION

EDITOR

DECEMBER 1938
VOLUME 85, NO. 12

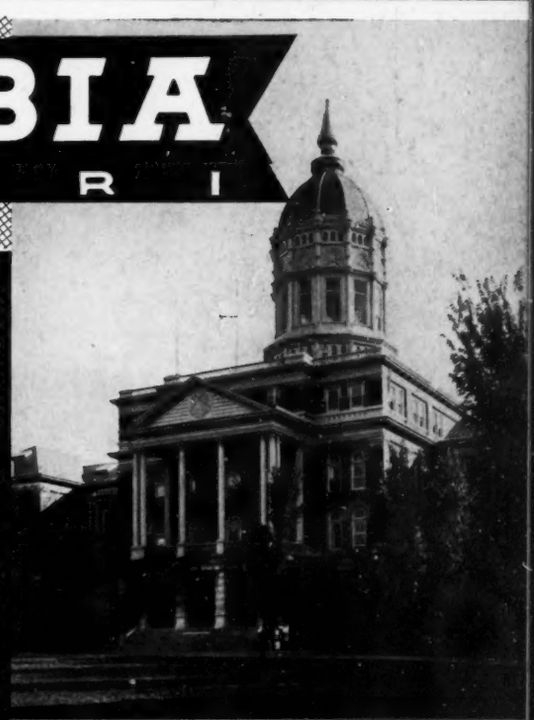
IN COLUMBIA MISSOURI

Columbia, Missouri, the county seat of Boone County, is a thriving, progressive city of 20,000 inhabitants. It was settled in 1821 by families migrating from Kentucky to find that this region "produced more and better blue grass than the richest soils" back home. The famous Daniel Boone was their forerunner by about 20 years.

In the region surrounding Columbia are dairy and truck farms, coal mines, stone quarries, and clay pits. Manufacturing includes flour, woodenware, shoes, brick, meat packing, smelting, and dairy products.

Columbia is the cultural and educational center of the state. Here are situated Stephens College, the largest Junior Girls' school in the world, and the University of Missouri, founded in 1839, just thirteen years after Columbia was incorporated as a city. A point of interest on the campus is a self-designed and inscribed monument of Thomas Jefferson, during whose administration the Louisiana Purchase was made.

Originally the water supply for Columbia came from a small creek nearby. Soon found unsatisfactory and inadequate, this was supplanted by deep wells. Now an abundant supply of pure water for the city's needs comes entirely from this source. The most modern and efficient equipment is employed including Pittsburgh Water Meters, which have made an outstanding contribution to the efficiency and economy of the entire system by their accurate and reliable performance.



UNIVERSITY OF MISSOURI

MUNICIPAL BUILDING

PITTSBURGH WATER METERS

PITTSBURGH EQUITABLE METER COMPANY
MERCO NORDSTROM VALVE CO.
NEW YORK · BUFFALO · PHILADELPHIA · KANSAS CITY · TULSA · LOS ANGELES
Main Offices - PITTSBURGH, PA.
DES MOINES · CHICAGO · COLUMBIA · MEMPHIS · OAKLAND · HOUSTON

Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co. Copyright 1938, U. S. Pipe & Foundry Co.

IN a world of change and uncertainty, cast iron pipe remains steadfast—a material you can bank on—basically the same today as for two centuries—yet more than ever the accepted standard for underground mains. Cast iron pipe is the product of a progressive industry which has attained high standards and uniformity in metallurgy and manufacture—well exemplified by U. S. Super-de Lavaud Pipe, centrifugally cast in a metal mold *without chill.*

UNITED STATES PIPE AND FOUNDRY COMPANY

Makers of Super-de Lavaud Centrifugally Cast Pipe and U. S. Pit Cast Pipe

GENERAL OFFICES: BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S. A.

U. S. CAST IRON PIPE

4 tough problems

THAT CALL FOR ARMCO SEWER PIPE

UNSTABLE FOUNDATIONS: Where shifting soils are likely to undermine and disjoint short sectional pipe, Armco Sewer Pipe offers a happy solution. No costly cradles or piling are needed to hold it in place because its long, flexible sections are tightly bolted together.

DEEP TRENCHES: To eliminate breakage and infiltration in deep sewers many cities are turning to Armco Sewer Pipe. When properly installed, it's virtually uncrushable because the corrugated metal design distributes the heaviest loads uniformly and harmlessly around the pipe.

SHALLOW COVER: In this "trouble zone" you can save much grief and expense by using Armco Sewer Pipe. Being flexible, it readily absorbs all the pressures resulting from frost action, sudden traffic impact and vibration. Moreover, tree roots won't clog an Armco Sewer.

AERIAL SEWERS: In crossing ravines or bridges Armco Sewer Pipe brings many desirable advantages. Because of its long lengths and freedom from excess weight it requires fewer and less costly supports. Besides, every joint can be made absolutely watertight to prevent leakage.

When sewers must serve under "tough" conditions like these, you'll save money and avoid trouble by using Asbestos Bonded Armco Sewer Pipe. Its flexible corrugated metal design and tightly coupled joints eliminate all danger of breakage or disjointing. Besides, Armco Sewer Pipe offers you this three-way assurance of long material life: (1) A galvanized base metal proved by more than 30 years of sewer service; (2) A smooth bituminous pavement that shields the bottom of the pipe from the scouring action of hydraulic traffic and a full coating of the same material that protects against acids, alkalies and gases; (3) A special asbestos bond that insures lasting adhesion of the bituminous material. Write for a free copy of the 48-page Armco Sewer Book, containing full information. Armco Culvert Mfrs. Assn., Middletown, Ohio.

ARMCO

Asbestos Bonded
ARMCO SEWER PIPE

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

WATER WORKS AND SEWERAGE, December, 1938. Volume 85. Number 12. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign, $3.00 per year. Copyright, 1938. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

Take your taffy in boxes...

not in Liquid Chlorine

WHAT is the chief source of the "taffy" that gives you trouble in a chlorinator? This Company has found that most of it comes from *hexachloroethane*–a common impurity in liquid chlorine.

Naturally, this is not the sole source of "taffy," for over-lubrication of chlorinator parts in contact with chlorine, failure of the oil chamber pressure gauge diaphragm, the entrance of moisture into chlorine chambers during shutdowns and similar occurrences may also cause trouble. But hexachloroethane is by all odds the worst offender.

That is why we have taken such great pains to eliminate it from the liquid chlorine supplied to you. We have developed a method that reduces this impurity to a point where operating troubles are virtually eliminated. This improved liquid chlorine is available in any desired quantity. We will gladly quote on your requirements.

PENNSYLVANIA SALT MANUFACTURING COMPANY · Est. 1850

Widener Bldg., Philadelphia, Pa.

New York · Chicago · St. Louis · Pittsburgh · Tacoma · Wyandotte

PENNSYLVANIA SALT *Chemicals*

CRANE PLUG DISC VALVES

FOR CHLORINATION SERVICE

There can be no compromise with the quality of equipment upon which the nation's health depends. That is why Crane designed the Special No. 254P Plug Disc Valve for the handling of chlorine gas for water sterilization.

Here's a valve that is built to do a specific job—with its ability to give better performance in that service backed by Crane design and Crane metallurgy—and a manufacturing experience of more than 80 years.

It's the Crane monel trim in the disc, seat and stem that give greatest resistance to the corrosive action of chlorine gas. It's the long-tapered disc and the wide seat that permit more positive flow control.

But it's Crane engineering all the way through—careful design and perfect balance in every part of the Special 254P, that is the greatest assurance of a longer life of valve efficiency on the chlorine gas lines in your plant.

CRANE

VALVES · FITTINGS · PIPE
PLUMBING·HEATING·PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO

NATION-WIDE SERVICE THROUGH 134 BRANCHES AND MORE THAN 500 WHOLESALERS

The Crane Special No. 254P Malleable Iron Valve for Chlorine Service. W. P. 400 pounds.

IT'S WHAT'S INSIDE THAT COUNTS!

MATHIESON CHLORINE SERVES LINCOLN SEWAGE PLANT

Says Wardner G. Scott, Engineer, Sanitary District Number One of Lancaster County, Nebraska:

"The quality of Mathieson Liquid Chlorine, together with the prompt service on shipments has been entirely satisfactory at all times."

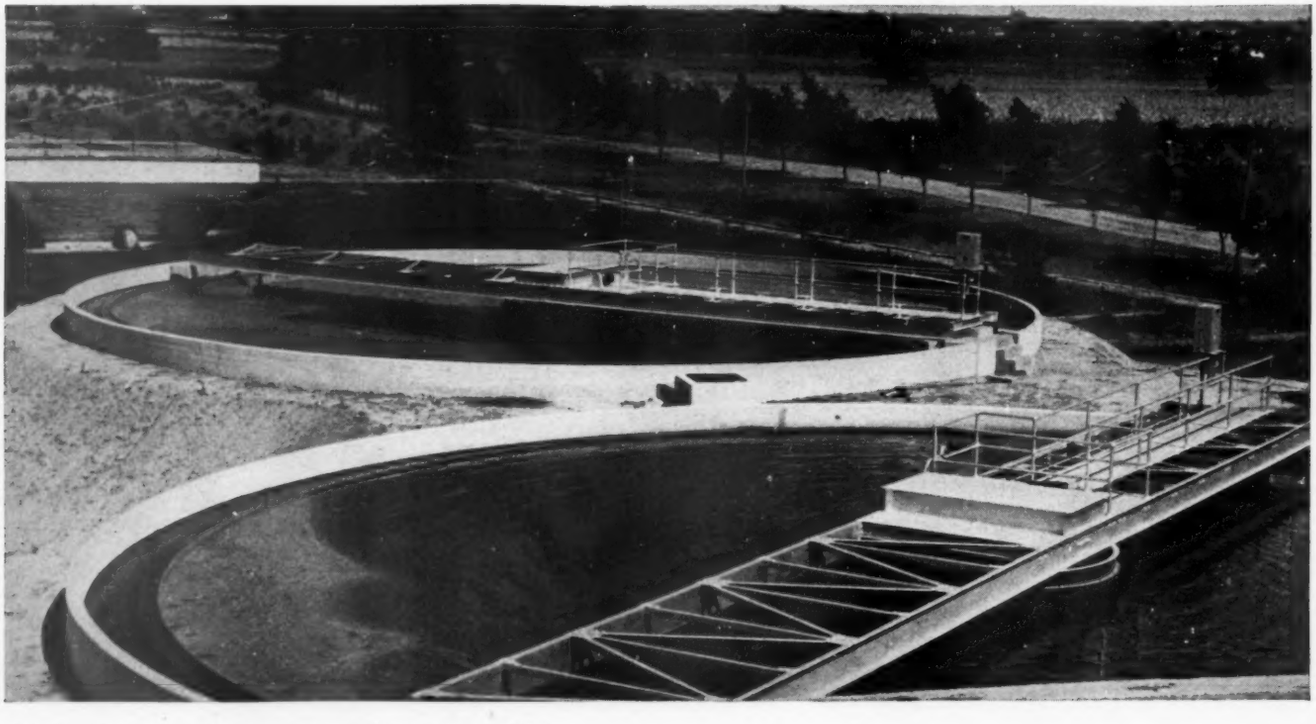
ABOVE all else, whether the job in hand be water purification, sewage treatment or swimming pool sanitation, your supply of liquid chlorine must be dependable. You have a right to expect at all times a pure product, trouble-free containers and valves, prompt delivery service.

At Lincoln, Nebraska, where the sewage treatment plant uses chlorine in ton containers, Mathieson Liquid Chlorine has been proving its dependability over a period of years. As Mr. Scott states, he has found the quality of the product and the prompt service on shipments entirely satisfactory at all times.

Because so many sanitary officials have had the same experience as Mr. Scott, they have learned to specify Mathieson whenever there is a chlorinating job to be done.

The MATHIESON ALKALI WORKS (*Inc.*)
60 East 42nd Street **New York, N. Y.**

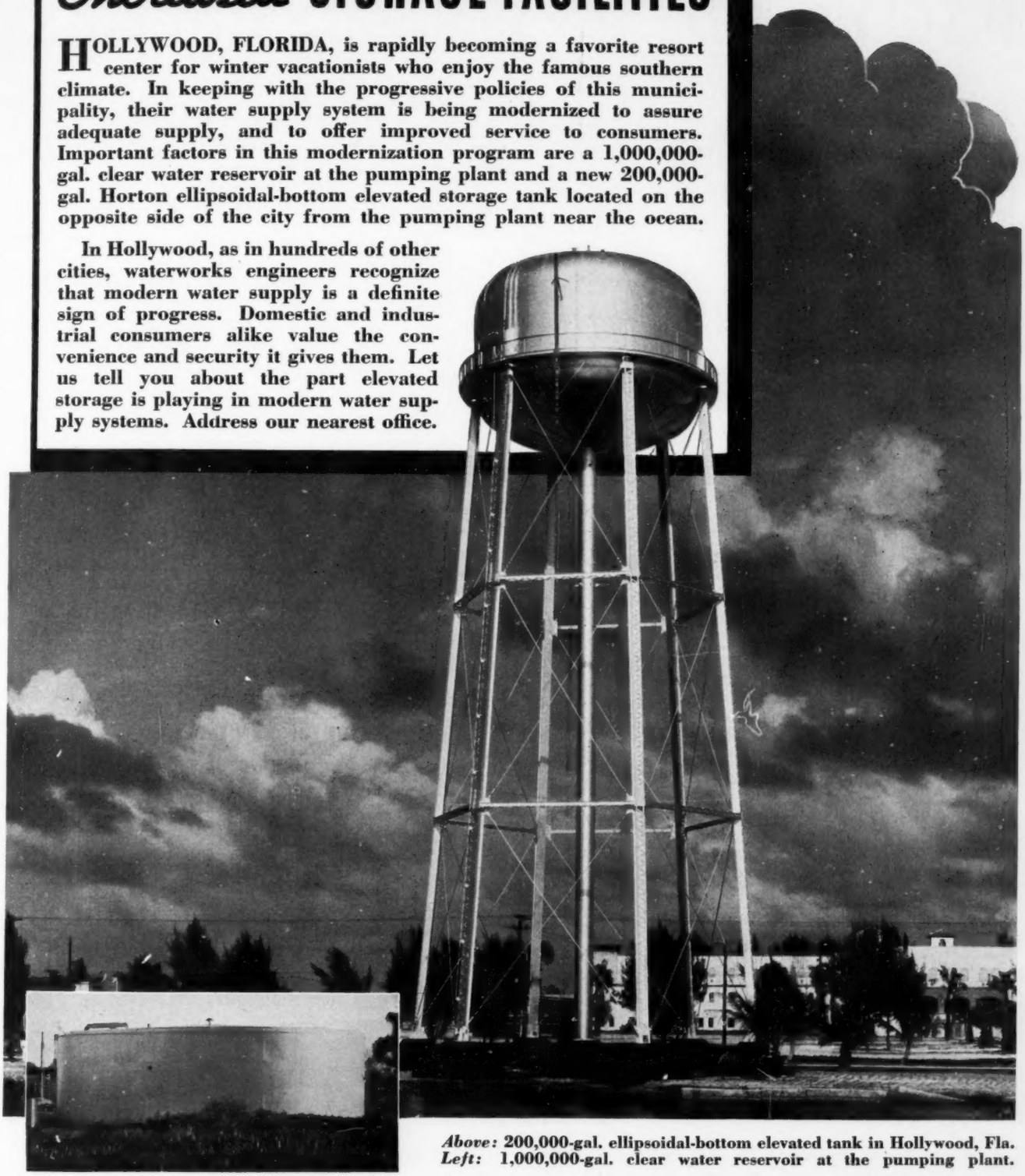
Soda Ash... Liquid Chlorine... Bicarbonate of Soda... HTH and HTH-15... Caustic Soda Bleaching Powder... Ammonia, Anhydrous and Aqua... PH-Plus (Fused Alkali) Dry Ice (Carbon Dioxide Ice)



Resort City Benefits from Increased STORAGE FACILITIES

HOLLYWOOD, FLORIDA, is rapidly becoming a favorite resort center for winter vacationists who enjoy the famous southern climate. In keeping with the progressive policies of this municipality, their water supply system is being modernized to assure adequate supply, and to offer improved service to consumers. Important factors in this modernization program are a 1,000,000-gal. clear water reservoir at the pumping plant and a new 200,000-gal. Horton ellipsoidal-bottom elevated storage tank located on the opposite side of the city from the pumping plant near the ocean.

In Hollywood, as in hundreds of other cities, waterworks engineers recognize that modern water supply is a definite sign of progress. Domestic and industrial consumers alike value the convenience and security it gives them. Let us tell you about the part elevated storage is playing in modern water supply systems. Address our nearest office.



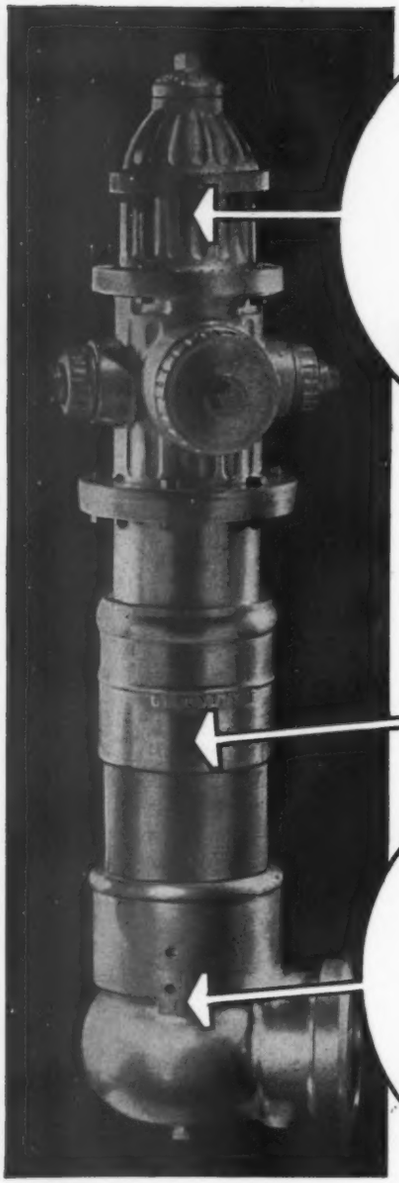
Above: **200,000-gal. ellipsoidal-bottom elevated tank in Hollywood, Fla.**
Left: **1,000,000-gal. clear water reservoir at the pumping plant.**

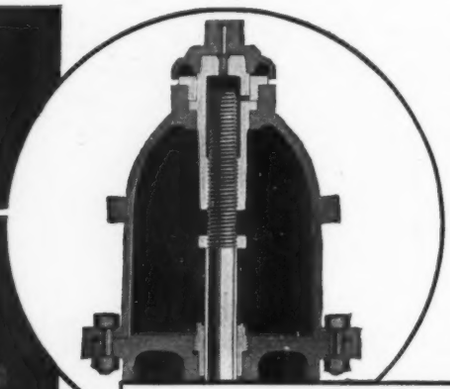
CHICAGO BRIDGE AND IRON COMPANY

Chicago	2404 Old Colony Bldg.	Birmingham	1560 North 50th Street	Philadelphia	1602-1700 Walnut St. Bldg.
New York	3364-165 Broadway Bldg.	Tulsa	1632 Hunt Bldg.	Boston	1527 Consolidated Gas Bldg.
Cleveland	2230 Rockefeller Bldg.	Houston	2919 Main Street	San Francisco	1027 Rialto Bldg.
Dallas	1429 Liberty Bank Bldg.	Detroit	1526 Lafayette Bldg.	Los Angeles	1442 Wm. Fox Bldg.

Before trouble starts, we ask you to

Install WINTERPROOF Mathews Hydrants!

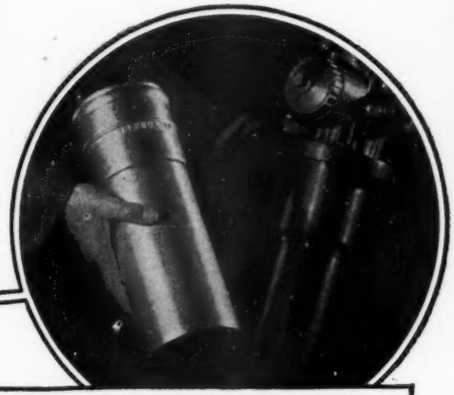




When winter really comes, water will freeze. If it freezes on your hydrants' operating threads or in their stand pipes, those hydrants can't be operated. If it freezes around your hydrant and heaves it loose from the main, your hydrant is out of service, you face expensive repair, and the leaking water can do tremendous damage. The Mathews is built to prevent all these things from happening. We believe it is the only hydrant which prevents them all. Install Mathews Hydrants. Assure your citizens all-winter fire protection.

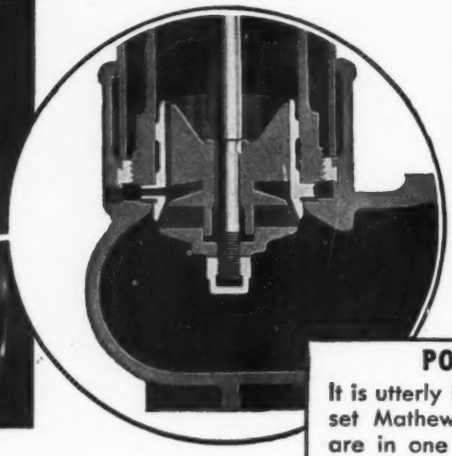
SEALED OPERATING THREADS

Snow, sleet, stream spray, and internal water are effectively excluded from these threads, which work in a waterproof chamber, protected from above by a roof-like shield operating nut, and protected from below by a cast iron wall.



SLIDING PROTECTION CASE

The upward thrust of frost-heaved ground is exerted, not on the water-carrying inner hydrant, but on a loose protection case which surrounds it and is free to lift with the heaving ground. This frost-protecting sleeve also allows the entire barrel to be unscrewed and lifted out without digging.



POSITIVE AUTOMATIC DRAINAGE

It is utterly impossible for water to stand in a properly set Mathews Hydrant. Its main valve and drain valve are in one piece. Therefore, as the main valve opens, the leather faced drain-valve must slide down across the drain-orifice effectively closing it. Conversely, as the main valve closes, the drain valve must open.

MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

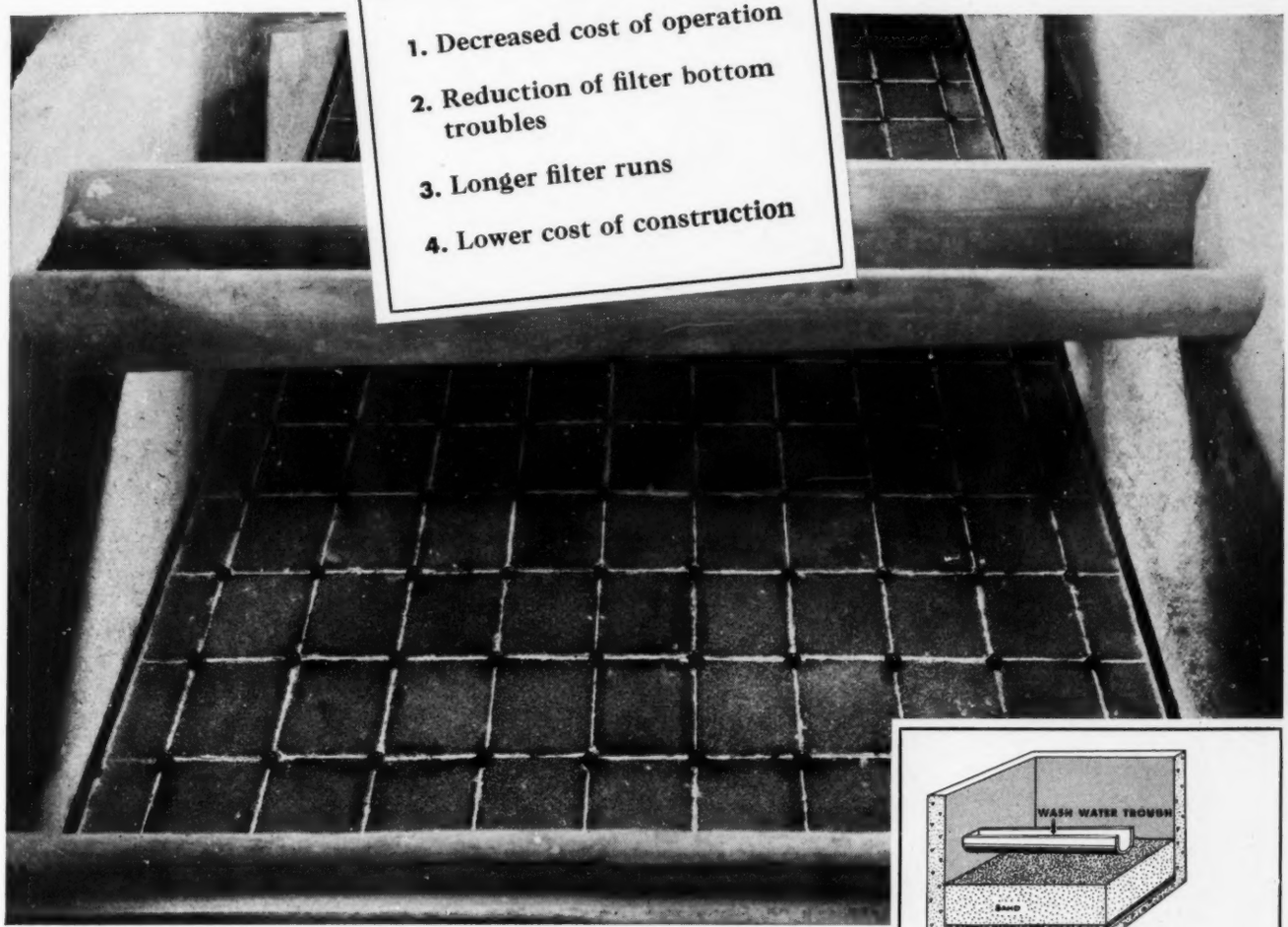
Manufacturers of Sand Spun Pipe (centrifugally cast in sand molds) and R. D. Wood heavy-duty gate valves for water works

400 CHESTNUT STREET, PHILADELPHIA, PA.

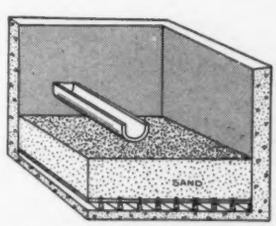
26 INSTALLATIONS

Are now proving the benefits of the Aloxite Brand Porous Underdrain System for rapid filters

1. Decreased cost of operation
2. Reduction of filter bottom troubles
3. Longer filter runs
4. Lower cost of construction



Filter with channeled plates



Filter with plain plates supported on concrete piers

POROUS CARBORUNDUM PRODUCTS

THESE benefits are realized through the inherent simplicity of design. Graded gravel is eliminated entirely. All vertical dimensions may be reduced accordingly.

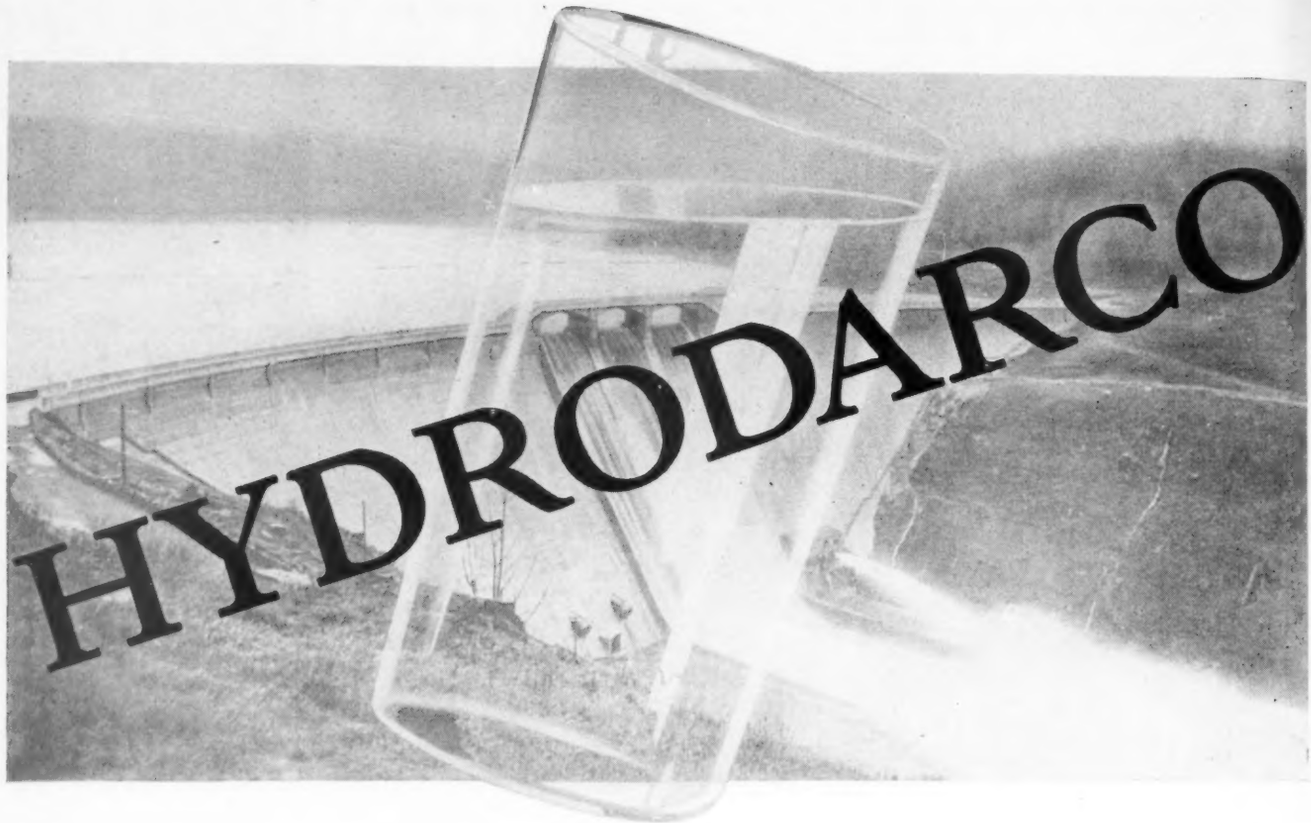
Write for further details. Our sanitary engineers are anxious to cooperate with consulting engineers and plant superintendents who are considering the design of new filters or the rehabilitation of old filters.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of The Carborundum Company)



Every Day HYDRODARCO Helps Supply Millions of People with Pure, Palatable Water

Throughout the country, water works chemists and officials rely daily on Hydrodarco to keep objectionable tastes and odors out of the water supply.

Hydrodarco does a superb job because it is designed to remove the particular tastes and odors found in water supplies. It is highly activated. It is finely ground. It has a high particle count. It disperses readily and rapidly. It handles easily in dry feed machines.

You can take the word of present users—or you can make your own test of the value of Hydrodarco. The Threshold Odor Test has proven both reliable and impartial for determining carbon efficiency in water treatment. Write today for a sample of Hydrodarco and a Darcograph set.

DARCO

DARCO CORPORATION

60 East 42nd Street, New York, N. Y.

Distributing Points

New York - - Buffalo
Cincinnati - - Chicago
St. Louis - New Orleans
Kansas City - - - San Francisco - Los Angeles
• Marshall, Texas •
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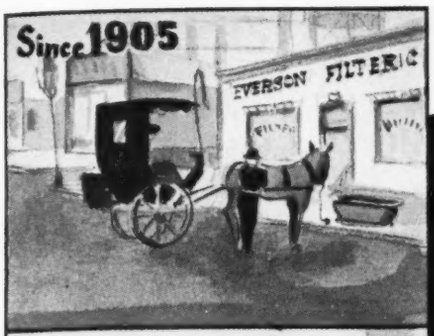
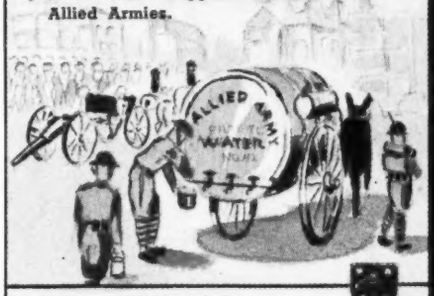
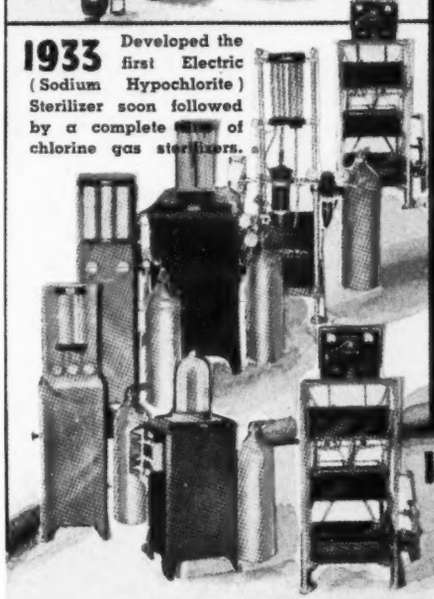


1914 Developed and Pioneered the Re-circulating System of Water Purification for swimming pools.

1917-18 Supplied field filters for Allied Armies.



1933 Developed the first Electric (Sodium Hypochlorite) Sterilizer soon followed by a complete line of chlorine gas sterilizers.



The Last Word

in CHLORINATING and AMMONIATING EQUIPMENT is the NEW AUTOMATICALLY SAFE

SterElators by Everson

AUTOMATIC WATER SHUT OFF

•

AUTOMATIC GAS SHUT OFF

•

AUTOMATIC SYNCHRONIZATION WITH PUMP

•

SINGLE VALVE OPERATION

•

VISIBLE ROTA METER
(accurate to plus or minus 1%)

•

OPERATES UNDER 20"
Water Gauge Vacuum

•

FAR WIDER METERING RANGE IN ANY CAPACITY
Standard Ratio 1-10

•

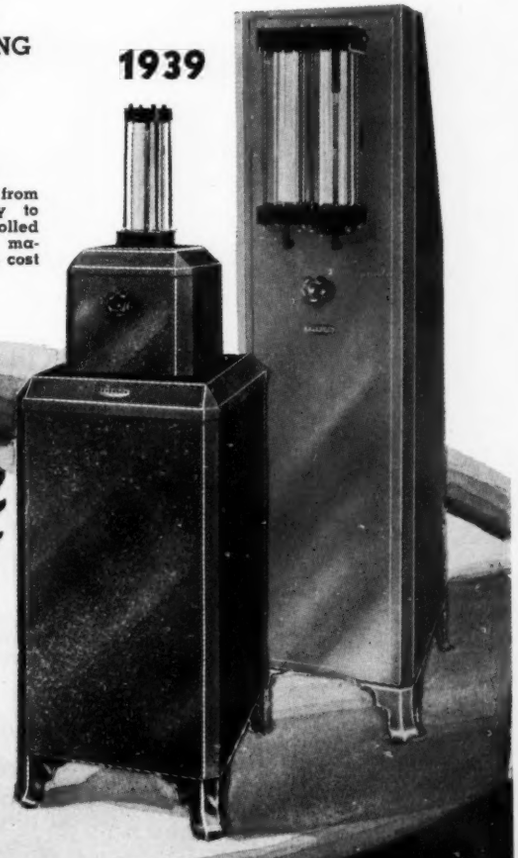
MULTIPLEX FEED
Feeds to two or more points from one SterElator, with quantity to each point individually controlled and metered—Virtually two machines for a fraction above the cost of one.

Thru almost 40 years EVERSON has been creating, developing and perfecting water treating and water purifying equipment. The sanitary modern swimming pool for example has been made possible by EVERSON. Great chains of restaurants rely on EVERSON equipment to insure the quality of drinking water. The Safety Electric SterElator is a patented EVERSON Development . . . and now EVERSON raises the accuracy and dependability and safety of chlorinating apparatus—for sewage and city water treatment with the EVERSON Automatically Safe, Vacuum operated SterElator, the most advanced of a long line of EVERSON sterilizing equipment.

•

Write for New Sewage and Water Works Bulletin No. 1004

1939



1938 announced the perfected EVERSON Safety Electric SterElator.

and now

EVERSON MANUFACTURING COMPANY

233 W. HURON ST. CHICAGO, U. S. A.

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New York	Detroit	Dallas	Nashville	Amarillo	Moline
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Financial National Security Bank, Chicago

That April Convention and Data Edition of WATER WORKS & SEWERAGE

is now on the desk of many hundreds of Water Works Superintendents, Sewage Superintendents, Chemists, Engineers and Municipal Officials. It serves as a ready reference manual that is of the utmost value in solving the varied problems that are constantly arising in the operation and maintenance of Water Works, Sewers and Sewage Treatment Plants. Its usefulness is such that it most appropriately has been called the "Operator's BIBLE" by men engaged in the Water Works and Sewerage fields. Plans are now being made for the 1939 Edition, which will incorporate many changes and a thorough revision of its text.

The Publishers

Check these 4 important SEWER-LINE SAVINGS

IN back of the remarkable success of Transite Sewer Pipe are four outstanding advantages that well deserve the attention of everyone interested in more efficient and economical sewage disposal.

SMOOTH INTERIOR PERMITS SMALLER PIPE OR FLATTER GRADES

Because of its smooth interior surface, Transite Sewer Pipe has an unusually high flow coefficient . . . C=140 or n=.009, for average slopes. Sewage flows more readily, carrying capacity is increased . . . therefore, smaller diameter pipe or flatter grades with shallower, less expensive trenches may be used. You save money either way.

TIGHT JOINTS MINIMIZE INFILTRATION, CUT TREATMENT COSTS

Transite's tight sleeve-type joints reduce infiltration to a minimum. Therefore, with less ground water in the line, the treatment plant has a much smaller volume to handle . . . another substantial saving.

LONG, LIGHT LENGTHS CUT INSTALLATION COSTS

The long, relatively light lengths of Transite Pipe cut handling costs, speed up installation and facilitate laying to an accurate grade. Furthermore, the 13-ft. lengths greatly reduce the number of joints to be poured. Again Transite cuts costs.

ASBESTOS-CEMENT COMPOSITION ASSURES LONG LIFE

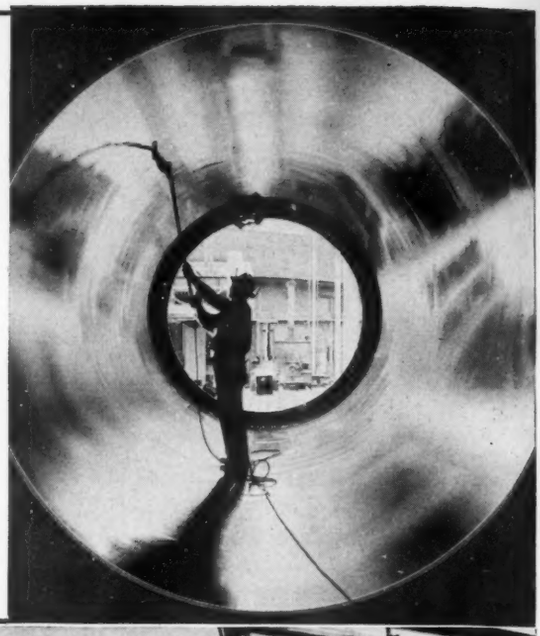
Made of two imperishable minerals . . . asbestos and cement . . . Transite Sewer Pipe cannot rust or decay and is highly resistant to all forms of corrosion. Maintenance costs stay low throughout the years.

• • •

These are a few of the many reasons why J-M Transite Pipe is so rapidly gaining favor with economy-minded engineers. The whole story of Transite . . . the many ways it improves the efficiency of any sewage system . . . is told in the *new* Transite Sewer Pipe brochure. For your *free* copy, write Johns-Manville, 22 E. 40th St., New York City.

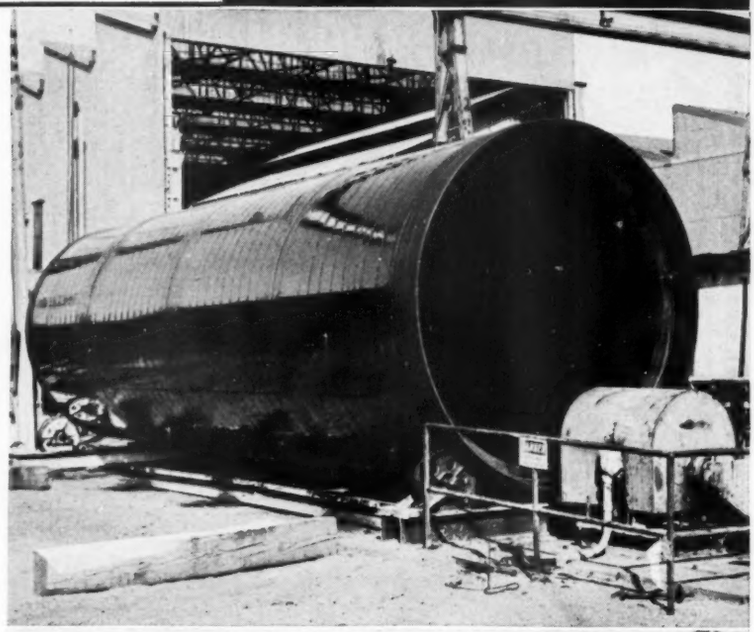
Johns-Manville
TRANSITE SEWER PIPE
An Asbestos Product

WORLD'S LARGEST AQUEDUCT RELIES ON *Reilly* PIPE ENAMEL AND PRIMER



● Among leading engineers, of aqueduct and pipe line projects—men who make it their business to *know*—REILLY PIPE ENAMEL and PRIMER hold the highest rating for economical and *dependable protection* against rust, corrosion, incrustation and tuberculation.

REILLY PIPE ENAMEL and PRIMER provide mirror-smooth protective coating securely bonded to the metal surface. Highly resistant to abrasion, REILLY coatings safely withstand wide temperature changes. Will not flow or sag at temperatures approaching 200° F. Will not crack or chip at temperatures as low as minus 20°. Specify REILLY coatings for dependable protection of *any* steel surface.



15 *PLANTS TO SERVE YOU*

REILLY TAR & CHEMICAL CORPORATION

Executive Offices:
Merchants Bank Building, Indianapolis, Ind.

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MOBILE, ALABAMA · MINNEAPOLIS, MINNESOTA

WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher — L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

REEVES J. NEWSOM,* Consulting Engineer, New York City, is to be this year's reviewer of **"PROGRESS AND DEVELOPMENT IN WATER SUPPLY AND TREATMENT"** scheduled for our annual water supply review number—the first issue of the new year. (*President of the American Water Works Association.)

THE NORTH CAROLINA SECTION OF A.W.W.A., long known for its prowess as a unit of the American Water Works Association, met last month in Greensboro, N. C. In this issue we had planned to carry the report covering the meeting. However, finding it necessary to devote the space allotted such reports to two earlier meetings, we must hold the N. C. report over for our next issue.

"SEWERAGE FINANCING" as presented by W. F. TEMPEST, Engineer of the Portland Cement Association, who has been making a survey and thorough study of this subject, presents an analysis of modern methods of sewerage financing, discusses the features of various methods (good and bad) and recites experiences of large and small communities employing sewer rental schemes. Mr. Tempest's contribution is both valuable and timely, because of the trend toward sewer rental charges which involve billing and collections through Water Departments.

"STABILIZATION OF CORROSIVE OR SCALE FORMING WATERS" continues to be a topic of paramount importance and of almost universal interest to the water supply profession around the world—industrial as well as municipal. In the recent attainments with treatment, involving applications of minute quantities of Hexa-meta-phosphate of sodium, such appears to be a development of importance which may rank with the now universally applied chlorination control by the residual chlorine method. We have been fortunate in securing CHAS. P. HOOVER and OWEN RICE as authors of an introductory article revealing means and accomplishments with the "Calgon" treatment of municipal supplies.

"STABILIZATION OF LIME SOFTENED WATER AND PRACTICAL METHODS OF TESTING" is a high rating contribution from H. O. HARTUNG, Chemist of the St. Louis County Water Co., which records experiences and results with two principal methods of stabilization at the St. Louis County plant. It constitutes a valuable sequel to the Hoover-Rice article and presents a discussion and careful evaluation of the new Hexa-meta-phosphate method in comparison with re-carbonation and other methods investigated.

"THE SEWAGE TREATMENT PLANT OF THE RAHWAY VALLEY, N. J."—is to be described by NORMAN C. WITTWER, Supervising Engineer, who was also resident engineer on the design and construction of this plant which serves nine communities and involved some unique design.

DR. W. RUDOLFS will contribute one or more articles disclosing developments of interest in sewage and waste treatment practices abroad—especially in reference to developments in Holland.

Vol. 85, No. 12

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Degreasing Sewage 1103
By GORDON J. WIEST
Chemist Sewage Treatment Works, Lancaster, Pa.

Results from the Use of Silicate as a Coagulation Aid 1108
By A. R. TODD
Chemist in Charge Filtration Plant, Wheeling, West Virginia

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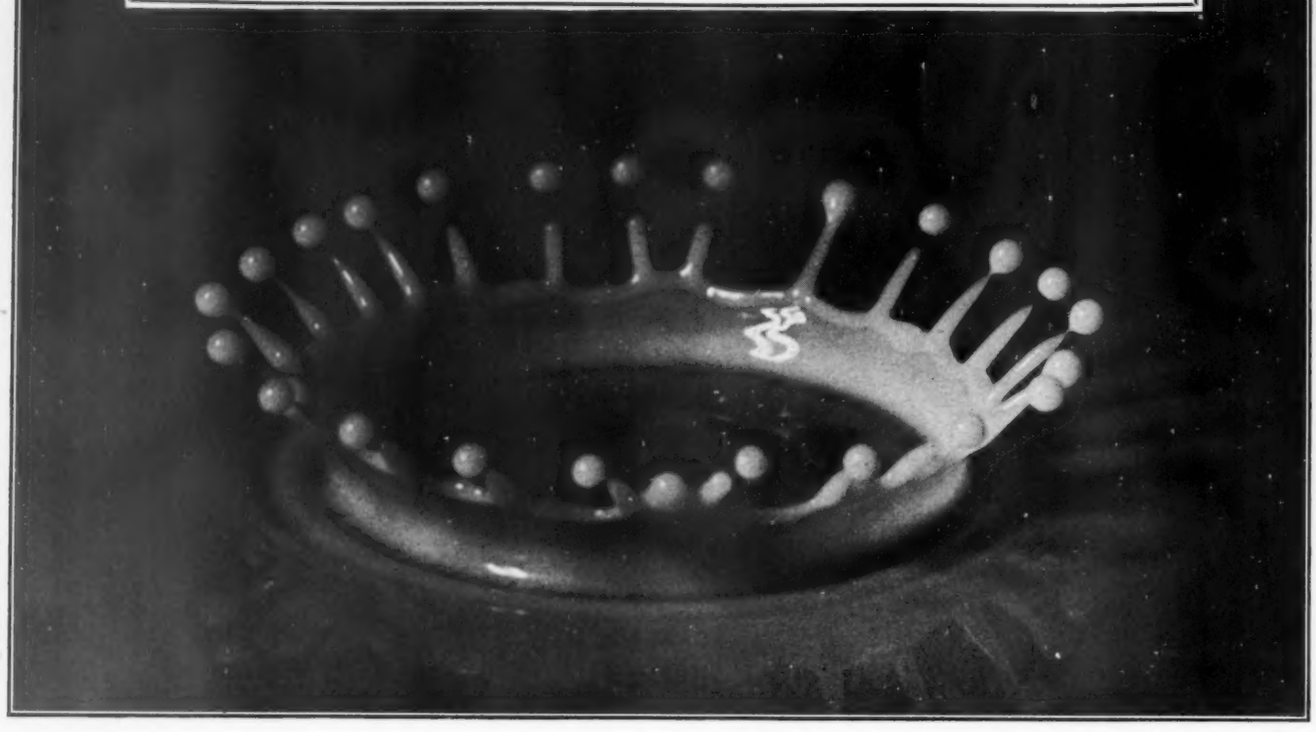

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WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 85 DECEMBER, 1938 No. 12

DEGREASING SEWAGE

Some Operating Experiences With the Aero-Chlorination Method at Lancaster, Pa

By GORDON J. WIEST
Chemist, Sewage Treatment Works, Lancaster, Pennsylvania

THE seperation of grease and oils from raw sewage is recognized as important to most sewage works operators, because the presence of these buoyancy producing materials in sewage lowers primary sedimentation efficiencies. Furthermore, they apparently interfere with efficient aeration and final clarification in the activated sludge process.

The Author

The method for degreasing sewage has been to aerate the sewage, utilizing air diffusion, for a short period as it flows through a channel or tank ahead of sedimentation tanks. This method has been practiced in a number of activated sludge type plants. The theory is that a violent diffusion of air bubbles sweeps the particles of grease and oils to the surface where coalescence and floatation results. The removal of the grease follows the pre-aeration and is effected by tank skimming by hand or with the aid of mechanical devices.

History

H. A. Faber, of the Chlorine Institute, in 1937 reported an improvement of this method of grease separation as a result of an experimental study conducted under his direction on a full plant scale at the Woonsocket, R. I., Sewage Treatment Works. Faber's method[1] was to admit gaseous chlorine into the air line serving the grease separation tank. This method of employing chlorinated air for grease separation has now come to be known as degreasing by "Aero-Chlorination." Faber reported an average chlorine dosage of 1.5 p.p.m. (based on sewage flows), with an average detention period of six minutes, increased the grease removal from 189% to 442% as compared to the use of aeration alone and employing the same quantity of air and contact period. The percentage increase in grease removal was based on pounds of wet grease (scum) removed per million gallons of sewage treated. Keefer and Cromwell, at Baltimore, Maryland, conducted similar experiments on a semi-plant scale at the Back River Sewage Treatment Works which results[2] confirmed Faber's findings at Woonsocket.

Lancaster Conditions

An investigation of the grease and oils present in the sewage at the South Plant in Lancaster, Pennsylvania, led me to believe that our difficulties could be minimized by attempting a method to increase the efficiency of our grease separation facilities. A laboratory investigation showed that grease and oils were present in the raw sewage delivered to the South Plant in rather variable and also comparatively high quantities. This laboratory investigation included a study of the grease content of the activated ("return") sludge. The "return sludge" at the South Plant averaged 21.63% (dry basis) grease, while the "return sludge" at the North Plant averaged but 5.0% grease. Briefly, Lancaster, Pennsylvania, has two sewage treatment plants—both being conventional activated sludge type design with separate sludge digestion. The North Plant was placed in operation in December, 1934, and has produced a high quality effluent with a minimum of difficulties. The South Plant, placed in operation in May, 1935, has since that time continuously offered a variety of problems which interfere with good operation.

The Lancaster Plants were designed for pre-aeration ahead of the primary sedimentation tanks. Screenings and grit are removed ahead of the pre-aeration channels. The pre-aeration channels are 6.5 feet in depth with diffuser plates on the bottom of the channels. The air delivered to these channels is measured and recorded in the Main Building. The grease removal after pre-aeration is effected by means of mechanical skimmers which carry the grease across the surface of the primary sedimentation tanks to the effluent end, where cross-skimmers remove the grease to collection pits. The grease is removed from the collection pits to the digestion tanks as required. The operation of the skimmers is not continuous; they are placed in operation for an average of five non-consecutive hours daily. The average detention period in the primary sedimentation tanks is 1.75 hours.

A Form of Aero-Chlorination Tried

The use of a form of Aero-Chlorination with hopes of improving grease separation was started at the South

Point of Chlorine Application
(Pre-aeration channel, with chlorinator house on left. Note the violent aeration at this point, for rapid and most effective distribution of small dosages of chlorine.)

TABLE I
AERO-CHLORINATION VS. AERATION ALONE

Date (1937) August	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
14	3.6	0.12	2.0	11.3
15	5.8	0 18	2.0	7.4
16	3.6	0.12	2.0	17.4
17	3.5	0.11	2.0	16.2
18	3.2	0.11	2.0	10.9
19	2.9	0.10	2.0	11.2
20	2.9	0 10	2.0	12.5
21	2.9	0.09	2.0	10.6
22	2.3	0.08	2.0	5.6
23	2.6	0.08	2.0	18.3
24	4.0	0.13	2.0	14.1
Average	3.4	0 11	2.0	12.3

Composite Samples: (Grease content)	Raw Sewage 25 p.p.m.	Primary Effluent 6.0 p.p.m.	% Removal* 76

Date (1937) August	Detention (minutes)	Air (Cu. Ft./Gal)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
26	2.9	0.09	None	4.9
27	2.9	0.09	None	4.3
28	3.0	0.10	None	2.2
29	4.0	0.13	None	1.6
30	2.9	0.09	None	6.1
31	2.6	0.09	None	4.8
Average	3.1	0.10	None	4.0

Composite Samples: (Grease content)	Raw Sewage 19 p.p.m.	Primary Effluent 9.0 p.p.m.	% Removal† 53

*On the basis of pounds of wet grease removed, per million gallons of sewage treated, Aero-Chlorination increased the grease removal 308%.

†On the basis of the analyses of raw sewage and primary effluent an increment of 23% is noted for the removal of grease using Aero-Chlorination over the use of aeration alone.

Plant under plant scale conditions in August, 1937. Chlorine in a gaseous form could not be injected into the air line serving the pre-aeration channels. So, a W. & T. vacuum type solution feed chlorinator was set up to feed chlorine in solution directly to the raw sewage just ahead of air diffusion. The chlorine solution feed line was anchored in front of a baffle submerged directly ahead of the sewage delivery line. This insured thorough mixing. The dosing of the chlorine (as at Woonsocket and Baltimore[1-2]) has been calculated on the basis of raw sewage flow, for ease in interpretation and weighing of data—including costs of the procedure.

A number of preliminary tests were made alternating aeration alone with Aero-Chlorination—as we shall designate the procedure, even though not strictly Aero-Chlorination. Comparisons were made from the appearance of the grease collecting on the surface of the primary sedimentation tanks. Aero-Chlorination invariably produced more grease on the primary tanks than aeration alone. Variable dosages of chlorine were applied to the sewage mixed with air and it was found that chlorine was lost when applied in excess of 3.0 p.p.m. (This gives some indication of how closely the air blowing followed the chlorine application.) An average of only 2.0 p.p.m. has been applied throughout the experimental measurements, to avoid possible loss of chlorine, and also because preliminary results indicated that a dosage of 2.0 p.p.m. was effective for the treatment desired.

Analytical Procedure

The performance of Aero-Chlorination, under plant scale conditions, was measured during defined experimental periods by determining the grease content of the raw sewage ahead of pre-aeration and of the effluent from the primary sedimentation tanks. The percentage grease removal was computed from the analytical results. The grease content of the raw sludge was also determined and the total grease removed computed. The method for the grease determinations followed Standard Methods of Water & Sewage Analysis (A.P.H.A.). The grease extractions were made, using petroleum ether throughout the experimental measurements reported. The grease was removed from the collection pits daily during experimental measurements and the weight was recorded after draining for not less than one hour. The weight of the grease was reported on a wet basis as pounds of wet grease removed per million gallons of sewage treated. The performance of Aero-Chlorination was compared with aeration alone, then without aeration or chlorination, and then chlorination alone. The grease content of the activated ("return") sludge was reported from time to time, since it is felt that the grease content of the "return sludge" may determine the efficiency of the activated sludge during aeration of the sewage sludge mixtures.

Results

Aero-Chlorination Alone

Experimental measurements were made from August 14th to 24th, 1937, using Aero-Chlorination. The chlorine dosage was 2.0 p.p.m. The experimental measurements continued from August 26th to 31st, 1937, using aeration alone. The results are shown in Table I. On the basis of the weighed pounds of wet grease removed per million gallons of sewage treated, Aero-Chlorination increased the grease removal 308% (see table) over the treatment using aeration alone. Laboratory analytical results showed a grease removal of 76%, using Aero-Chlorination and a grease removal of 53%, using aeration alone.

These experimental measurements were repeated from September 5th to 15th, using Aero-Chlorination and com-

parative tests were made September 20th to 30th, using aeration alone. The chlorine dosage was 2.0 p.p.m. The results appear in Table II. On the basis of pounds of wet grease removed per million gallons of sewage treated, Aero-Chlorination increased the grease removal 373% over the treatment using aeration alone. Laboratory analytical results showed a grease removal of 78%, using Aero-Chlorination, and a grease removal of 63%, using aeration alone.

Controlled Check Tests—3 Methods

In February, 1938, due to the interruption of plant operations caused by the presence of excessive quantities of gas wastes in the sewage; it was possible to maintain fairly constant operating conditions over a period of time for experimental observations of the performance of Aero-Chlorination. The sewage flow was maintained at 4.0 M.G.D., giving a constant value for detention period and air applied. Chlorine was applied at 2.0 p.p.m. A five-day test was made February 17th to 21st, using treatment without pre-aeration and without chlorine. Another five-day test was made March 4th to 9th, using pre-aeration treatment alone. A third test was made March 16th to 21st, using Aero-Chlorination. The results of these measurements under rather constant conditions are shown in Table III. On the basis of pounds of wet grease removed per million gallons of sewage treated, aeration *alone* increased grease removal 187% over the treatment without aeration and without chlorine; Aero-Chlorination increased the grease removal over aeration alone by 417%; and Aero-Chlorination increased the grease removal 781% over the treatment without aeration and without chlorine. Laboratory analytical results showed 38% grease removal, using treatment without aeration and without chlorine; 50% grease removal, using aeration alone; and 80% grease removal, using Aero-Chlorination.

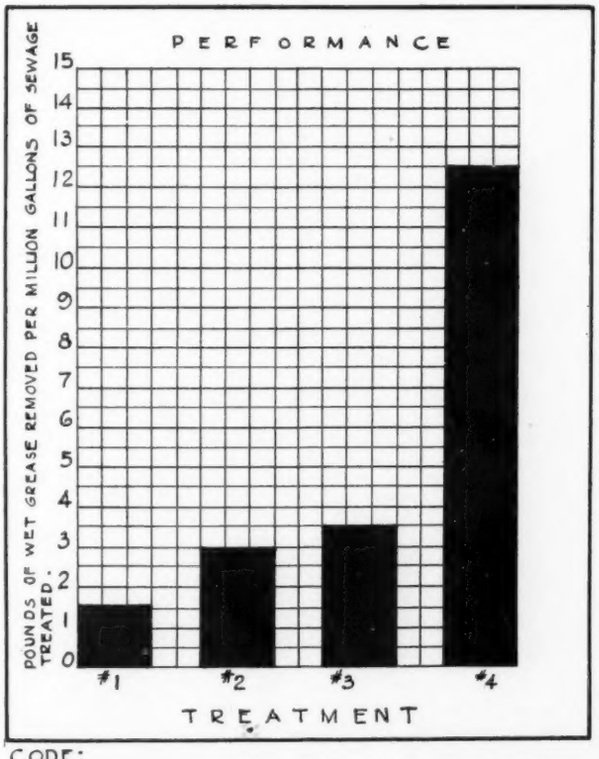


Fig. 1

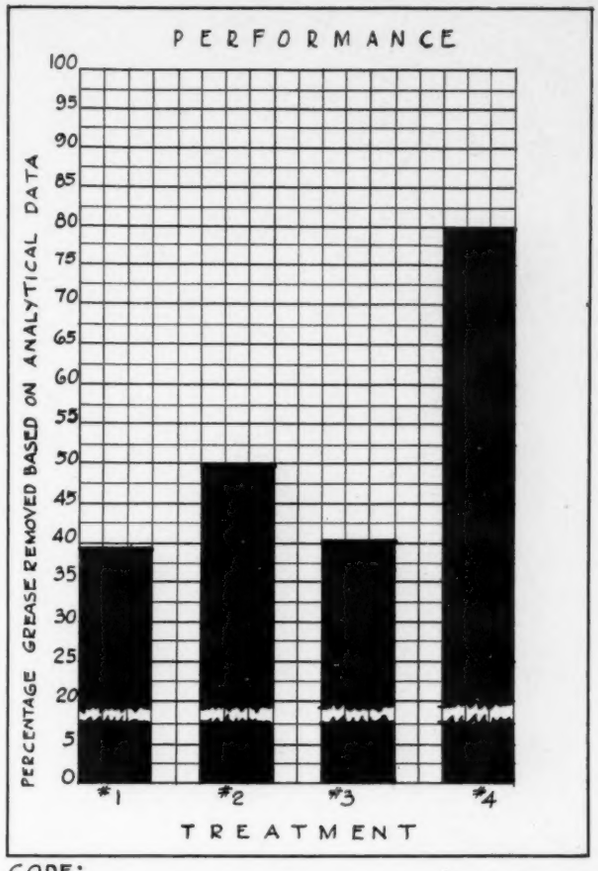


Fig. 2

The grease determinations on the raw sludge and the scum removed are reported for these experimental periods in Table IV.

Chlorination Alone

Experimental measurements were made, using chlorination alone for grease separation on three successive Mondays and three successive Wednesdays during July, 1938. These measurements were made at the suggestion of H. A. Faber of the Chlorine Institute. The results appear in Tables V, VI, and VII. Mondays and Wednesdays were the days selected for these measurements because experience showed that the raw sewage has a maximum grease content on Mondays and an average grease content on Wednesdays. The chlorine dosages were 2.0 p.p.m. The experimental conditions as to the dosing of chlorine and plant operation were parallel to the experimental conditions during the previous measurement periods, using Aero-Chlorination, aeration alone, and the treatment without aeration and without chlorine. The appearance of the grease collecting on the primary tanks was visibly present in smaller quantities than during the treatment using Aero-Chlorination. On the basis of pounds of wet grease removed per million gallons of sewage treated, chlorination *alone* increased the grease removal 219% over the treatment without aeration and without chlorine; and chlorination *alone* increased the grease removal 117% over the treatment using aeration *alone*. However, Aero-Chlorination increased the grease removal 371% over the treatment with chlorination alone. These comparisons are made, using the average of the results reported in July, 1938, and the results reported

TABLE II

AERO-CHLORINATION VS. AERATION ALONE

Date (1937) Sept.	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
5	3.1	0.09	2.0	6.5
6	3.5	0.11	2.0	15.7
7	2 9	0.10	2.0	17.1
8	2.9	0.10	2.0	12.4
9	2.9	0.10	2.0	16.8
10	3.5	0.11	2.0	18.5
11	4.1	0.13	2.0	11.4
12	4.3	0.14	2.0	5.9
13	3.9	0.12	2.0	18.0
14	4.3	0.13	2.0	14.5
15	5.8	0.18	2.0	15.2
Average	3.7	0.12	2.0	13.8

Composite Samples: (Grease content)	Raw Sewage	Primary Effluent	% Removal*
	23 p.p.m.	5.0 p.p.m.	78

Date (1937) Sept.	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
20	3.8	0.12	None	4.3
21	3.5	0.11	None	3.4
22	3.5	0.11	None	4.1
23	3.9	0.12	None	2.6
24	3.3	0.10	None	3.5
25	3.2	0.10	None	4.3
26	3 9	0.12	None	2.8
27	3.4	0.10	None	5.7
28	3.4	0.10	None	3.8
29	3.4	0.10	None	2.3
30	3 4	0.10	None	4.4
Average	3.5	0.11	None	3.7

Composite Samples: (Grease content)	Raw Sewage	Primary Effluent	% Removal†
	27 p.p.m.	10.0 p.p.m.	63

*On the basis of pounds of wet grease removed, per million gallons of sewage treated, Aero-Chlorination increased the grease removal 373%.

†On the basis of the analyses of raw sewage and primary effluent an increment of 15% is noted for the removal of grease using Aero-Chlorination over the use of aeration alone.

in February and March, 1938. The analytical results showed chlorination alone removed 41% of the grease. The grease analyses of the raw sludge and the grease collected are reported in Table VII.

Improvement in Activated Sludge Noted

The grease content of the activated ("return") sludge has been determined at frequent intervals since Aero-Chlorination has been in use. The grease content of the "return sludge" at the South Plant has been reduced between 64% and 74%. To our mind, this improvement has been due to Aero-Chlorination. These results are shown in Table VIII.

Discussion and Summary

The grease content of "return sludge" may determine the efficiency of the aeration of sewage sludge mixtures. It is believed that the presence of grease and oils in the "return sludge" and the sewage sludge mixtures do not permit the balancing of rate of oxygen utilization, because the grease and oils spread a protective film on the sewage and sludge particles, making intimate contact, and resulting oxidation slow and incomplete. Also, the absorption of the colloidal matter present in the sewage by the "return sludge" is not complete in the presence of grease and oils, because of this protective film. Aero-Chlorination of the raw sewage for grease removal does reduce the grease content of the sewage and sewage sludge mixtures to a marked degree; thereby, bringing the rate of oxygen utilization into a proper balance. The results at Lancaster show that Aero-Chlorination reduced the grease content of the raw sewage to the extent of 80%.

As the result of our tests and study of benefits derived, Aero-Chlorination has been made an operating feature at both of the sewage treatment plants of Lancaster. Since introducing Aero-Chlorination, the South

TABLE III

THREE METHODS COMPARED

Date (1938) February	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
17 (Thursday)	4.3	None	None	1.3
18 (Friday)	4.3	None	None	1.9
19 (Saturday)	4.3	None	None	0.9
20 (Sunday)	4.3	None	None	2.1
21 (Monday)	4.3	None	None	1.6
Average	4.3	None	None	1.6

Composite Samples: (Grease content)	Raw Sewage	Primary Effluent	% Removal*
	21 p.p.m.	13.0 p.p.m.	38

Date (1938) March	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
4 (Friday)	4.3	0.14	None	3.1
5 (Saturday)	4.3	0.14	None	2.9
6 (Sunday)	4.3	0.14	None	2.6
7 (Monday)	4.3	0.14	None	2.0
8 (Tuesday)	4.3	0.14	None	3.1
9 (Wednesday)	4.3	0.14	None	4.4
Average	4.3	0.14	None	3.0

Composite Samples: (Grease content)	Raw Sewage	Primary Effluent	% Removal*
	26 p.p.m.	13.0 p.p.m.	50

Date (1938) March	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
16 (Wednesday)	4.3	0.14	2.0	10.4
17 (Thursday)	4.3	0.14	2.0	13.2
18 (Friday)	4.3	0.14	2.0	12.9
19 (Saturday)	4.3	0.14	2.0	15.3
20 (Sunday)	4.3	0.14	2.0	7.5
21 (Monday)	4.3	0.14	2.0	15.7
Average	4.3	0.14	2.0	12.5

Composite Samples: (Grease content)	Raw Sewage	Primary Effluent	% Removal*
	21 p.p.m.	4.0 p.p.m.	80

*On the basis of pounds of wet grease removed, per million gallons of sewage treated, aeration increased the grease removal 187%. Aero-Chlorination increased grease removal over aeration alone 417%. Aero-Chlorination increased grease removel 781% over the treatment without aeration and without chlorine.

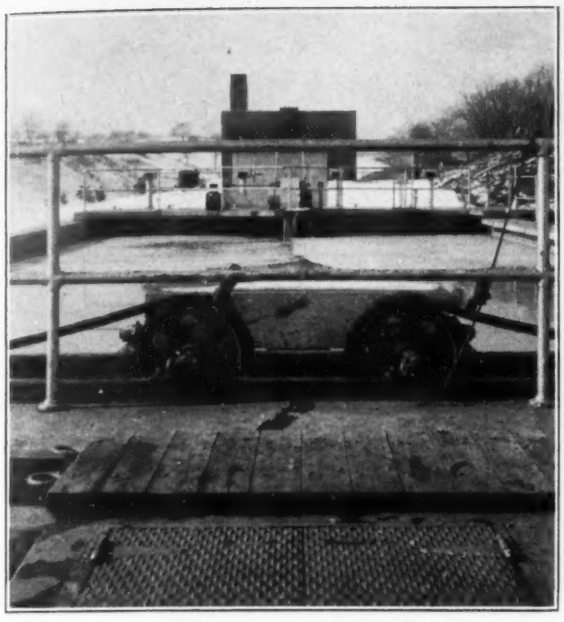
*On the basis of analyses of raw sewage and primary effluent an increment of 12% is noted for the removal of grease using aeration, over the treatment without aeration and without chlorine. An increment of 30% is noted using Aero-Chlorination over aeration alone. An increment of 42% is noted, using Aero-Chlorination over the treatment without aeration and without chlorine.

TABLE IV

GREASE CONTENT OF PRIMARY SLUDGE AND SCUM

Date	Treatment	Raw Sludge Pct.	Scum Pits Pct.
1937—			
Aug. 14-24	Aero-chlorination	27.56*	14.65*
Aug. 26-31	Aeration alone	32.08	12.69
Sept. 5-15	Aero-chlorination	25.67	16.34
Sept. 20-30	Aeration alone	31.17	14.19
1938—			
Feb. 17-21	Without aeration and without chlorine	31.19	10.17
March 4- 9	Aeration alone	30.08	11.19
March 16-21	Aero-chlorination	26.68	12.87

*Grease as determined by Standard Methods of Analysis—A.P.H.A.



Primary Sedimentation Units

(Note the surfaces covered with liberated grease which the skimming mechanism removes.)

Plant in Lancaster has experienced its first six months of continuously successful operation of the activated sludge phase of treatment. A high quality effluent has been *consistently* produced for the past six months, with a continuous and pleasing absence of "bulking" troubles.

TABLE V
PRE-CHLORINATION ALONE

Date (1938) July	Detention (minutes)	Air (Cu. Ft./Gal.)	Chlorine (p.p.m.)	Wet Grease lbs./M.G.
11 (Monday)	4.1	None	2.0	2.7
13 (Wednesday)	3.7	None	2.0	1.9
18 (Monday)	3.4	None	2.0	4.7
20 (Wednesday)	3.4	None	2.0	3.1
25 (Monday)	3.4	None	2.0	4.8
27 (Wednesday)	2.9	None	2.0	4.0
Average	3.5	None	2.0	3.5*
Maximum	4.1	None	2.0	4.8
Minimum	2.9	None	2.0	1.9

*On the basis of pounds of wet grease removed, per million gallons of sewage treated, the treatment using chlorination alone increased the grease removal 219% over the treatment without aeration and without chlorine. The treatment using chlorination alone increased the grease removal 117% over the treatment using aeration alone. These comparisons are made using the average of the results reported in July, 1938, and the results reported in February and March, 1938.

TABLE VI
PRE-CHLORINATION ALONE
(Grease Content in p.p.m.*)

Date (1938) July	Raw Sewage	Primary Effluent	% Grease Removal
11	16	11	31
13	12	7	41
18	21	13	38
20	18	10	44
25	23	11	52
27	17	10	41
Average	18	10	41
Maximum	23	13	52
Minimum	12	7	31

*By Standard Methods of Analysis—A.P.H.A.

TABLE VII
PRE-CHLORINATION ALONE
(Grease Content—Dry Basis*)

Date (1938) July	Raw Sludge Pct.	Scum Pits Pct.
11	31.63	13.09
13	28.65	12.39
18	35.09	15.37
20	36.11	14.29
25	34.61	14.86
27	33.96	15.10

*By Standard Methods of Analysis—A.P.H.A.

TABLE VIII
QUALITY OF ACTIVATED ("RETURN") SLUDGE

Date	April (1937)	May (1938)	July (1938)	August (1938)
Per cent grease*	21.63	7.78†	6.56†	5.61†
Per cent total solids	0.82	1.02	1.54	1.42
Per cent volatile solids	74.21	77.74	79.32	79.67

*Petroleum ether extraction by Standard Methods.

†Percentage reduction of grease content of Activated ("Return") Sludge:

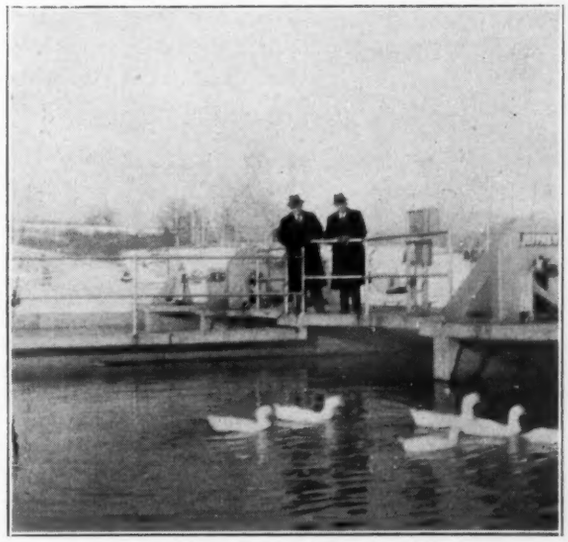
	Pct.
April, 1937, to May, 1938	64
April, 1937, to July, 1938	70
April, 1937, to August, 1938	74

Acknowledgment is made to L. H. Enslow and H. A. Faber of Chlorine Institute for their helpful suggestions and guidance.

The Department of Streets and Public Improvements is responsible for the management of the Lancaster Sewage Treatment Works. J. A. Taylor, Director; J. H. Shertzer, City Engineer; and E. J. Rhoads, Superintendent.

[The text of this article was presented, in a large measure, before the Pennsylvania Sewage Works Association, as the author's contribution to the "Clinic" held annually in diagnosing or solving problems of the operator. It has since been redrafted and amplified for publication in "Water Works and Sewerage." —Ed.]

References:
[1]H. A. Faber, Water Works & Sewerage, 84, 171 (1937).
[2]Keefer & Cromwell, Water Works & Sewerage, 85, 97 (1938).



"Guardian Angels" of the South Plant.

These white ducks of Lancaster keep "activated" in our final clarifiers. No—they were not bleached by the chlorine. Looking on are our Commissioner, J. A. Taylor, and T. H. Shertzer, City Engineer.

RESULTS FROM THE USE OF SILICATE AS A COAGULATION AID

Experiences at the Wheeling, W. Va., Filtration Plant

By A. R. TODD

Chemist in Charge, Filtration Plant, Wheeling, W. Va.

THE silica content of the Ohio River water at the intake of the Wheeling plant varies in the same manner as do other constituents. For example, the folowing are recorded variations:

Constituent	P.P.M.
Turbidity	1 to 1450
Total Alkalinity	12 to 20
Carbon Dioxide	2 to 45
Iron	0.2 to 12
Manganese	trace to 4
Silica	2 to 12
pH	3.8 to 7.4

The Author.

A normal raw water for Wheeling, such as we handle over 60 per cent of the time, has approximately the folowing average characteristics:

Constituents	P.P.M.
Turbidity	10
Total Alkalinity	3
Carbon Dioxide	12
Iron	4*
Manganese	2*
Silica	8.9
pH	4.8

Effects of Flood Flows

During normal river conditions lime, ammonia, and chlorine are the only materials needed to satisfactorily treat the water better than half of the time. In the case of flood flow, here is what happens. The turbidity, total alkalinity, and pH increase; the carbon dioxide, iron, manganese, and silica decrease. The iron, manganese, and silica will reach their low point about eighteen hours after the crest of the flood and remain so for a period of approximately seventy-two hours. During this seventy-two-hour period we have to deal with a turbidity of colloidal nature that has been exceedingly difficult to cope with. The turbidity will range from 80 to 240 p.p.m. Although, under normal conditions, 0.2 of a grain of copperas (ferrous sulphate) per gallon (in addition to the iron naturally in the water) is ample to effect good coagulation, more than ten times this (even 3 grains of alum, or ferrous sulphate or ferric sulphate) will not give satisfactory results.

This condition worried us a great deal and we could give no explanation as to why it should be so. After John R. Baylis, in his articles in WATER WORKS AND SEWERAGE, revealed that it was the absence of silica that was responsible for poor coagulation in Lake Michigan and some other waters, we decided to run daily silica determinations on the raw and finished water at Wheeling. After we had been making these daily tests for about six weeks, getting fairly constant results of around 8 p.p.m. of silica in both the raw and finished water, we experienced some high water so we ran silica four times daily and found that following a flood silica, like the iron content, dropped to almost zero. We then decided to secure some silicate of soda for trial as a coagulation aid at the next opportunity.

Some Astonishing Results

We had only a few weeks to wait for the next high water. Some fifty laboratory trials were carried out to test the value of silicate additions. The results were indeed outstanding. It was found that 0.2 of a grain of copperas and 0.2 of a grain of silica in the form of silicate of soda would give better results than as much as 3 grains of copperas alone. Further, that most any combination of silicate and copperas would effectively coagulate the water. We then ordered five drums of silicate of soda to make a plant scale test, and waited for the next high water. Again we did not have long to wait, for we had some five minor floods this past spring.

In the plant tests we first tried 0.1 of a grain of silica and 0.2 of a grain of iron on a post-flood water with a turbidity of from 180 to 450 parts. The results were disappointing, the water coming over to the filters having a residual turbidity of 25 parts. We then increased the silica to 0.2 grains and the results were outstandingly clear cut. Within seven hours the water was reaching the filters with a turbidity of less than 1 p.p.m. We then cut off the silica; and, in six hours we had a turbidity of 25 again on the filters. Again we started the silica feed, and again it cleared up. This convinced us, without a shadow of a doubt, that it must be the absence of silica in the raw water as the reason why post-flood waters at Wheeling will not coagulate properly. We have found that excellent results are obtained by feeding the diluted silicate of soda through the same feed line that conveys the ferrous sulphate solution. Also, that chlorine can be fed at the same time through the same line.

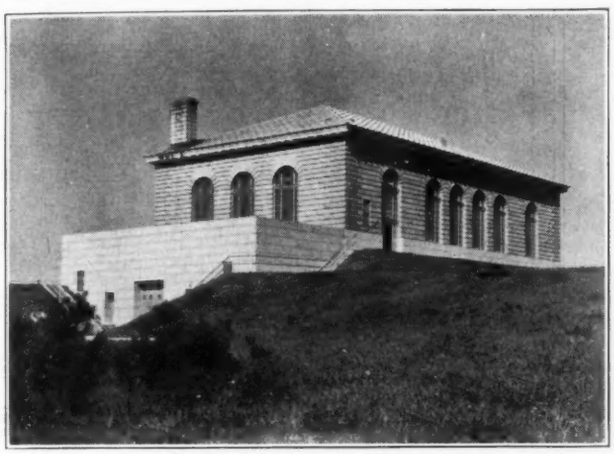
Acknowledgment—This paper was read before the West Virginia Conference on Water Purification, at Morgantown, W. Va., Oct. 15, 1938.

*Contributed in the form of acid mine drainage and spent acid pickling liquors from steel mills and plants manufacturing steel products.

CHLORINATING PLANT DESIGNED FOR MAXIMUM SAFETY

By HOMER G. SHOCKLEY
Asst. Engr. Designer, Board of Water Supply, New York, N. Y.

DOWNTAKE Chamber No. 2 at Hillview Reservoir is located on a hill directly above a residential section of Yonkers, N. Y., and only 1,000 feet north of the New York City line. Due to the proximity of this highly developed residential section the New York City Board of Water Supply engineers deemed it necessary to provide an unusually comprehensive system of safety measures in this plant to prevent the escape of chlorine from all points of possible leakage. Especial attention was given to the handling of one-ton chlorine containers and the possible need for disposal of leaking chlorine therefrom.



Hillview Chlorinating Station
Downtake Chamber No. 2 on Tunnel No. 2 to which the chlorine storage and supply room has been added at the near end.

The chlorinating and pump rooms are installed on the main floor of the Downtake Chamber No. 2. A chlorine storage room is provided in a lower-level addition at the southerly end of the structure. In this room provision was made for the storage of chlorine containers of 1-ton capacity. In the same room are the scale pits that will accommodate 16 scales for drums in an upright position or 8 scales for drums horizontally. Five scales to handle drums in horizontal position were installed, leaving space for three more if later required. There also is a 3½-ton electric traveling crane and a truck stall for expeditious handling of the chlorine containers and other equipment. In addition there is a heating plant, a fuel bin, office room, and lavatory.

Safety Design Features

The primary safety measure consists of a 12,000 c.f.m. exhaust fan connected, through an elaborate system of exhaust ducts, with 13 take-off ports located at suitable places in the floor. In case of a chlorine leak developing, the fan is to be immediately started, causing the escaping gases to be rapidly exhausted (from floor level) through the ducts and discharged with considerable velocity up a chimney flue into the air for rapid dispersion well above the main building. Next, the operator (with or without a gas mask as the circumstances may demand) closes the leak if readily possible. Should the leak be from the container proper or its valves, and can not be readily stopped, the container is lowered into a chlorine tank-well, provided for the purpose, as a "third line" safety measure.

The Pressure-Tight Tank-Well

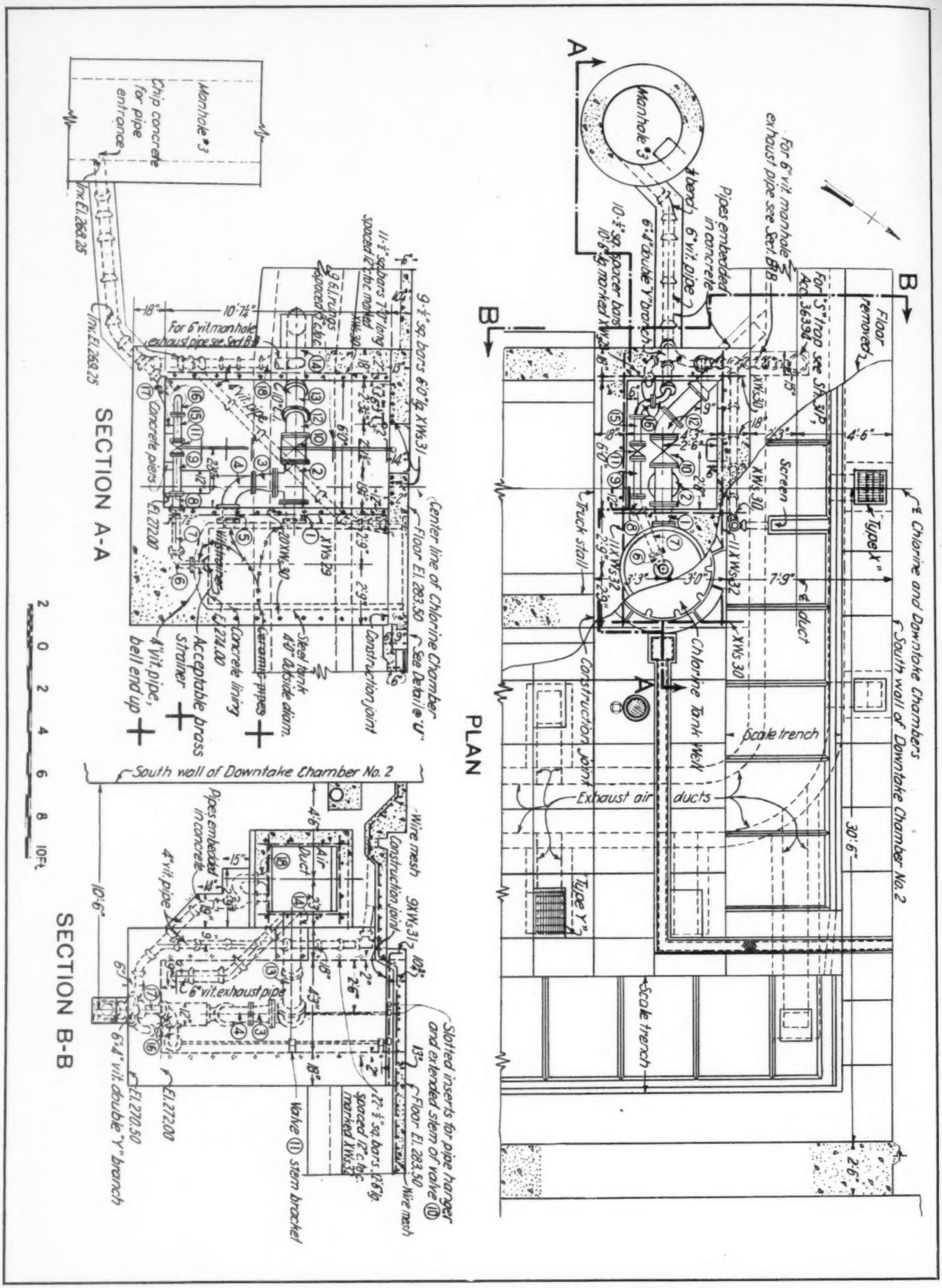
This tank-well is located in the floor of the storage room immediately in front, and about the center, of the scale pit that is in use (see picture); and it has a pressure cover that may be securely bolted down. This cover is designed to withstand considerably more pressure than is normally developed within the chlorine containers themselves. Taking out, just under this cover, is a ¾-in. chlorine gas line that extends to one of the regularly operated chlorinators. At the bottom of the tank-well is a 4-in. drain, connecting to a manhole of a large blow-off conduit of the main chamber. Leading off from the side of the well, near its vertical center, there is an 8x10-inch reducer connecting through a 10-in. exhaust pipe to the main exhaust duct of the exhaust system. There is an 8-in. trap drain leading from this 10-in. pipe back into the well at a lower level. This was designed to trap and return any liquid chlorine which might form in the exhaust pipe from the well. There is also a 4-in. drain connection from the exhaust duct through an S-trap to the blow-off conduit manhole, starting very near to the connection with the exhaust pipe from the well.

The ¾-in. gas supply line to the chlorinator room is controlled by a primary chlorine valve located under a plate cover close to the well. The exhaust and drain pipes are controlled by valves located in a manhole on the opposite side of the well from the ¾-in. emergency gas supply line. These valves are operated by means of valve stems leading to the floor surface. These stems are beneath the checkered plates seen alongside of the well cover in the general view of the chlorine room.

The tank-well consists of a ½-in. steel cylinder tank, 4-ft. outside diameter, lined with cement concrete and connected by a riveted joint to a 1½-in. cast-steel manhole frame with swiveled bolt connections for the cast-steel pressure cover, all embedded in reinforced concrete with the top of cover at the floor level. The net interior dimensions are 3-ft. 6-in. diameter by 8-ft. 10-in. depth. The accompanying illustrations show the general arrangement and many of the details.

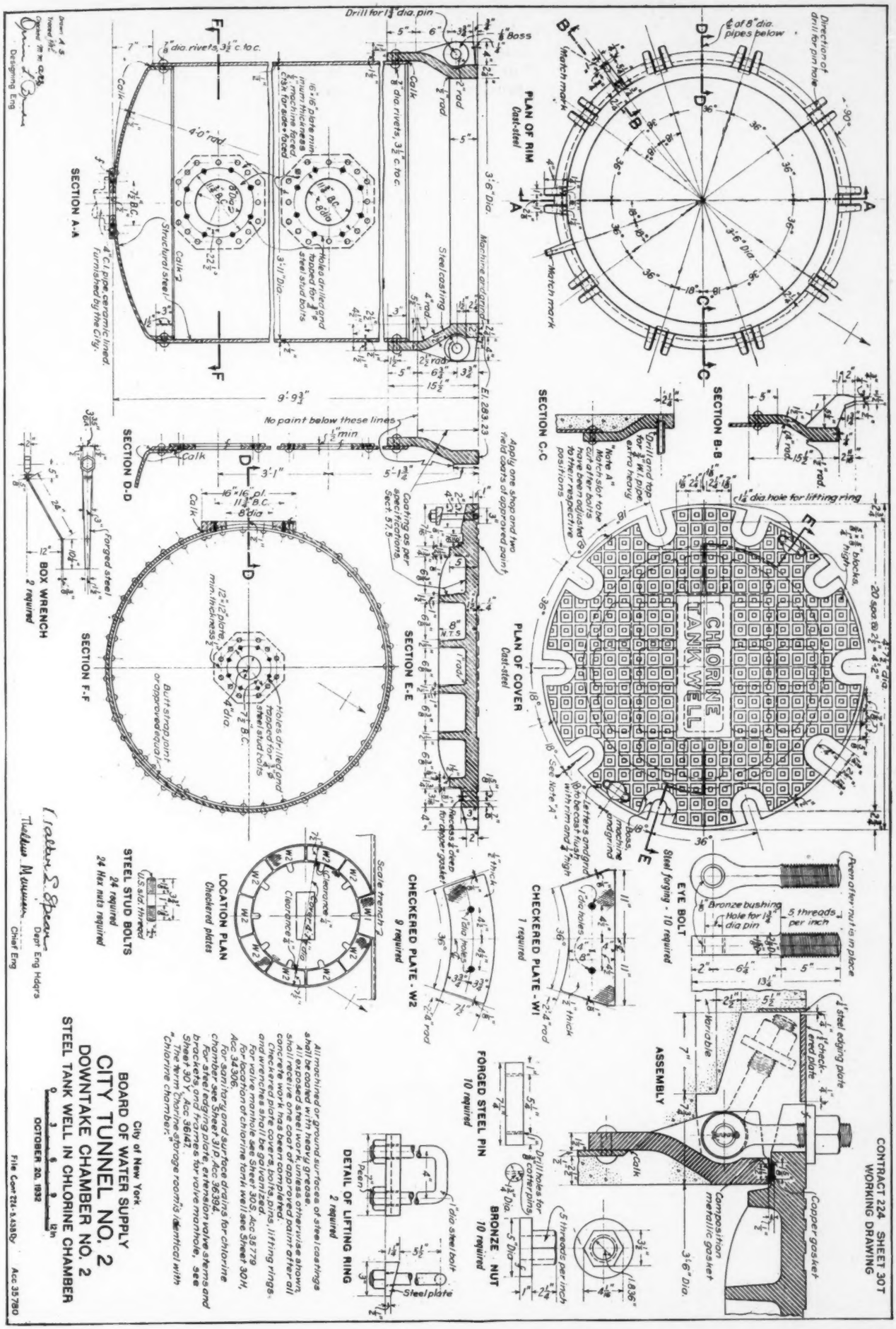
Container Handling Equipment

The storage room is equipped with two types of one-ton container lifters. One is of a more or less standard type of spread hooks for handling chlorine containers in the horizontal position. The other type seen in the pictures, is for use in picking up and handling a drum in the vertical position required for standing it on end in storage or on the scales, more particulaly for lowering



Emergency Chlorine Pressure Chamber, Showing Valving and Piping Details.

Water Works and Sewerage—December, 1938



Chlorine Pressure Chamber and Lid in Detail.
Note gasketed lid with bolts in service, and in dropped back position under annular plate.

it into the emergency pressure-well. The designers studied a number of alternative models and schemes for picking up and handling drums vertically but finally provided a design recommended by the operating engineers of the Department of Water Supply, Gas and Electricity as found satisfactory to them at other chlorinating plants.

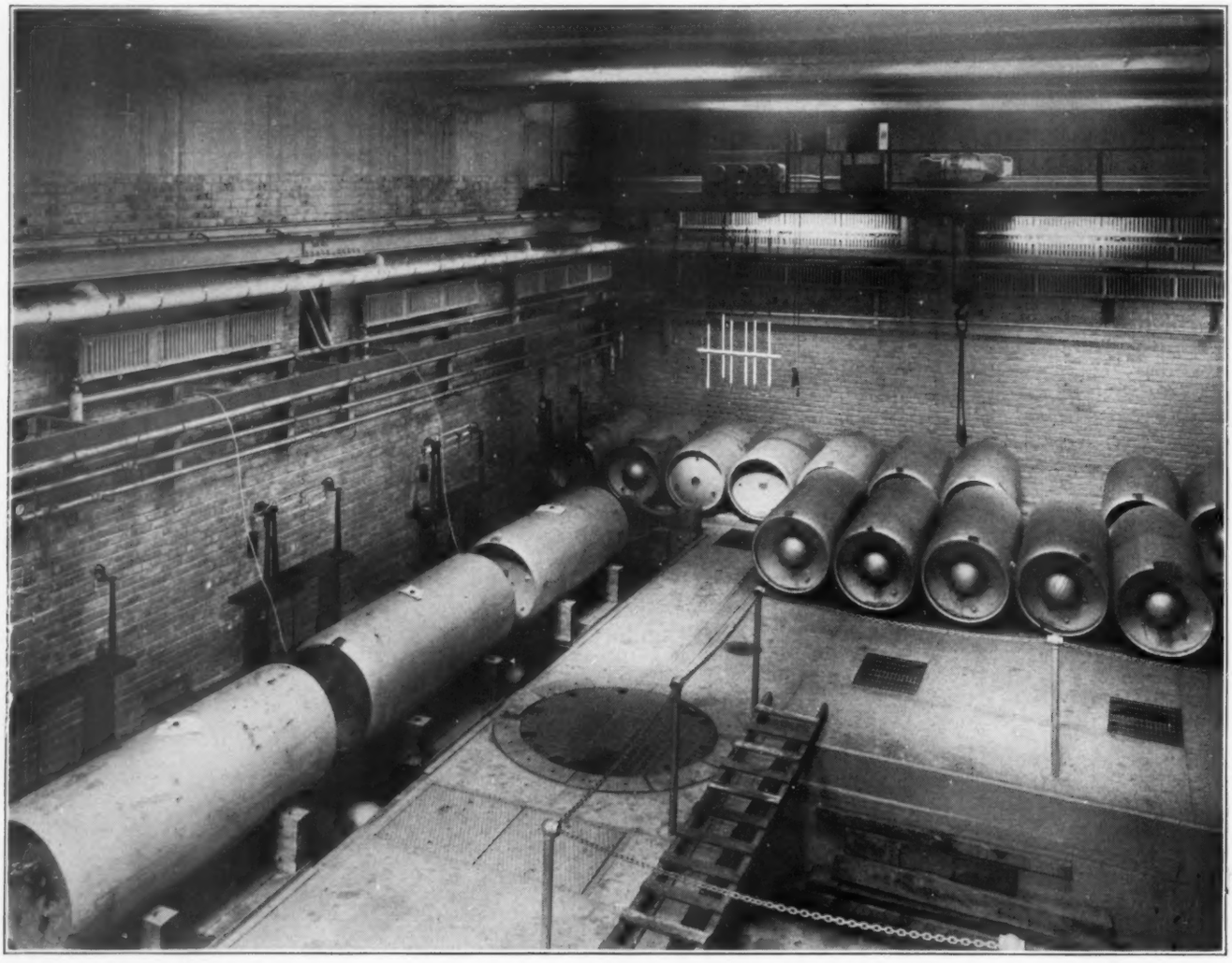
There is a considerable degree of flexibility of methods available to the operator in the use of this safety equipment. When a leak develops in a drum or its valves, the first move would be to don a gas mask, start the exhaust fan and, later, open doors and windows as desired. Under some circumstances this might be all that would be necessary to enable the operator to make some slight adjustment or repair. If the leak be more serious or proves beyond safe limits in a further attempt at repairing, the next step is to remove the well cover and up-end the drum, by means of the traveling crane, after buckling on the vertical tank lifter. Then to lower the drum into the tank well and replace the gasket and lid. The next move is subject to the decision of the operator, and depends largely upon his good judgment as to the best way to utilize the well-tank in the particular circumstance.

Alternate Methods of Leaking Chlorine Disposal

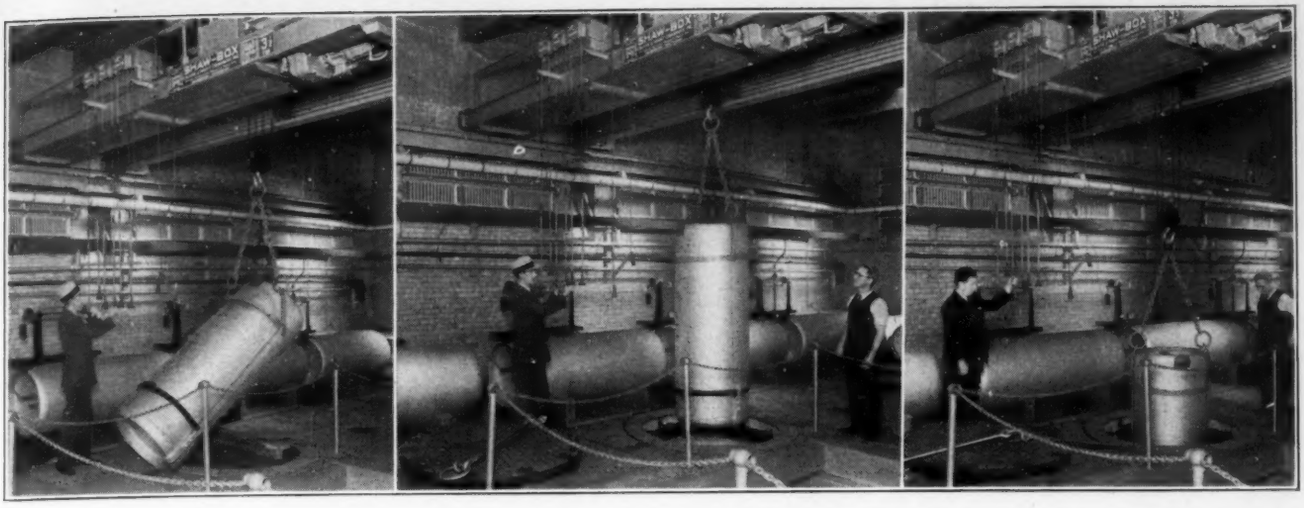
(1) If the leak seems to warrant it, the operator may bolt the cover down tight over the grease-treated asbestos gasket provided for the purpose, close exhaust and drain valves, and open the primary valve of the ¾-in. gas line to the chlorinator. When sufficient pressure shall have developed in the well from the leaking gas, as recorded on the pressure gage between the primary and secondary valves, the secondary valve may be opened to allow gas to feed through the chlorinator. In order to allow the drum to empty itself more expeditiously it might be advisable, with the main exhaust valve temporarily open, to open wide a drum valve just before bolting down the cover of the well, after which the main exhaust valve would be closed and the gas utilization procedure followed from that point on.

(2) With the chlorinator supply line valves closed, the cover either bolted on or placed loosely, the drain valve open or closed as desired, and the exhaust valve completely open, the operator may use the exhaust system to draw the escaping gas through the ducts and discharge it into the air above the chimney. If the amount of leaking gas were great and the dispersion of the gas above the chimney and building seemed insufficiently rapid to prevent annoyance to nearby residents, especially if the wind be unfavorable, this method should not be used for long if at all. In that case the gas should be piped to the chlorinator until the supply becomes exhausted as evidenced by pressure readings.

The above-described methods are contemplated as the normal ones to be used in such emergencies, which of course will happen rarely or may not happen at all. How-



A General View of the Chlorine Room at Hillview Station. In foreground is the truck stall, for easy and safe handling of containers; emergency tank-well in center foreground; the checkered plates cover the valve well; in center, two of several grating covered exhaust ports at floor level; chlorine header pipes lead to chlorinators on floor above.



Up-ending and lowering the Ton Container. Note the harness which is applied by buckling a single strap to hold lifting irons from slipping on the chime.

ever this vertical pressure tank-well is also very well adapted for the following alternatives if it be desired to use them:

(a) The drum in the well may be flooded with water so that the water will carry off through the drain and blow-off conduit the leaking gas in solution or as chlorine hydrate. This practice however would seem less meritorious and more hazardous than the next.

(b) With all valves closed and cover off the well, the leaking drum may be covered over with strong caustic soda solution or a slurry of lime that will absorb the escaping gas to form hypochlorite draining and replenishing the solution as found necessary.

(c) Cracked ice, mixed with coarse salt, as for ice cream manufacture, may be packed around the drum in the well in order to cool the chlorine contents down to a point where the low pressure will readily allow a leaky valve to be removed and replaced, with little or no danger to the operator. The exhaust line will create a down suction to take off escaping gas. The same results may also be accomplished by procuring and using solid carbon dioxide, or "dry ice," from the nearest source of supply.

As an auxiliary structure to New York's deep 17-ft. diameter pressure tunnel, this chamber with its equipment was constructed under the direction of Chief Engineer Thaddeus Merriman, now consulting engineer for the Board. Walter E. Spear, now chief engineer, was then department engineer of Headquarters Department, which includes the designing divisions; and Charles M. Clark, now deputy chief engineer, was the department engineer of the Aqueduct Department supervising the construction. Roger W. Armstrong, now headquarters department engineer, was Engineer Clark's chief assistant. The design was done under the immediate direction of Designing Engineer Orrin L. Brodie. Drawings and photographs were furnished by the courtesy of Department Engineer Armstrong.

With respect to this safety equipment, the designers owe much to the kindly cooperation and courtesy of Engr. L. H. Enslow of the Chlorine Institute, to whom they often went for technical information concerning chlorine, the various methods of handling it, and existing safety methods employed in chlorination procedures and handling of chlorine containers.

TRUE ENOUGH

Noting the attractive three color illustration on the front-cover of Monsanto's *"Current Events,"* the worthy house-organ of Monsanto Chemical Co. of St. Louis, Mo., we found on the table of contents page the above. Under the heading "Fractionations" this column highlights the contents of the issue.

We are reproducing it here, thinking what a nice bit

Fractionations

ON THE COVER

The thirsty boy exemplifies the high standard of American health and sanitation. Parents are confident about permitting their small children to serve themselves from the tap, for the consistent purity of our "processed" water is expected and accepted.

The subject of weather may only be a topic of conversation and the study of meteorologists, but health is more than talk and next in importance to food with most people.

Whether the youngster drinks water with consent and confidence, swims in a public pool, or takes a shower bath at the local fire station, his health and happiness are dependent on the vigilance and knowledge of the water and sanitary engineers. Our orchids to the men who give us safe water.

* * *

of local water utility publicity the copy and illustration would make—especially if the brochure cover was done in color as was the case of the September issue of Monsanto's *"Current Events."*

In the same issue is an interesting story of "The Green Goddess—Chlorine" which reveals accurately the history of chlorine in water supply and sanitation. Another deals with an interesting new compound for softening water. The whole issue, in fact, is devoted to water supply and health in a most attractive manner. It's worth writing for.

JUST AN EXCHANGE OF IDEAS

Wherein "Wire Nail Chemistry" Stands a Small Plant Operator in Good Stead; and a Student of Dale Carnegie Is Rewarded With a Crate of Soda Pop—"On the House"!

By ROLAND J. LEVEQUE

Supt. of Filtration,
Fredericksburg, Virginia

The Author

WHEN Robert Burns wrote his memorable line, "The best laid schemes o' mice and men gang aft a-gley," he must have had filter plants on his mind.

Engineers design and build what they consider "le dernier cri" in filter plants, only to have them in many instances cross up the dope when put into operation, displaying more temperament than the proverbial "Prima Donna." Fortunately, as new plants are erected, we see faults in design minimized, if not entirely eliminated, which is just swell for the fellow who steps in to operate a new plant, but what of the fellow who has to struggle along with a plant of ancient and sometimes questionable vintage?

Mr. and Mrs. America are apt to be tolerant, good natured, and even willing to be bamboozled occasionally in everything they buy, except the water they drink. It matters not that the town's consumption of this commodity has increased to the point where it becomes necessary to operate your plant on overloads ranging from 20 to 60 per cent. Neither does it matter that you are delivering a product so good that it can be used in storage batteries in lieu of distilled water. Just let a taste of chlorine get through and Mr. and Mrs. America will be clamoring for your blood. Will they accept alibis, or legitimate excuses . . . yes, they will not! And while you're being read the riot act, you can bet that they will ring in that old one about the chlorine killing their goldfish, to say nothing about Aunt Minnie's colitis taking a turn for the worse due to the mineral content, and "those chemicals" with which we dose the water.

At such times, when the consumer's dander is up, alibis and legitimate excuses are practically useless, therefore to reduce these telephonic broadsides to a minimum, it behooves the poor maligned plant operator to indulge in a bit of invention in self-defense, so before you can say "Hydronaphthoquinone" he produces a "gadget" which he hopes will compensate for the existing ills in his plant.

"The Home of the Gadget"

That some of these gadgets resemble mechanical devices such as one would expect to find only in a "Rube" Goldberg cartoon, does not detract one iota from their merit, and in the numerous plants about the country, particularly in the smaller ones, there are operators who are bridging the gaps, by means of these little gadgets. True, in the small plant—"Home of the Gadget"—operation and maintenance methods may seem a bit elementary. But only because the small plant operator, in discharging the duties of superintendent, chemist, mechanic, office boy and janitor (all at once) has little time to envelope the process in a haze of mystery, and it is therefore not to his discredit if he leaves this phase to the savants, while he resorts to his gadgets and practical methods which help him to deliver a water that meets with the highest standards, day after day.

The operators of water purification plants are not engaged in a competitive business, therefore it is only natural that we find a true spirit of co-operation existing between members of the waterworks fraternity. Ideas are freely exchanged, and a willingness to help the other fellow solve his problems is the rule rather than the exception. This exchange of ideas we sometimes refer to as "Kinks on Operation and Maintenance," and because the writer has at various times derived much benefit from articles devoted to "Kings and Gadgets," it is his desire to contribute a few in the hope that they may prove of some help where similar conditions might exist. They are presented in the form of plant experiences, and while they have proven successful in overcoming the difficulties at hand, they are not offered as infallible remedies for similar ills in other plants.

Wire Nails and Iron Troubles

Several years ago, and shortly after this plant (Fredericksburg, Va.) had been put into operation, a complaint that city water was staining linens in the shrinking vats, was received from a local clothing factory. We immediately concluded that this was being caused by too low a pH together with the carbon dioxide content of our finished water, dissolving iron from the mains and producing the well known "Red-Water." An additional chemical feeder was installed in our plant and soda-ash was fed to the plant effluent, raising the pH to 8.5. Despite these corrective measures, the complaints still persisted.

At that time we were not familiar with the marble tests for determining the corrosiveness of water, consequently a bit of invention was in order. Several slightly rusted, but cleaned, nails were placed in a jar of our finished water to observe whether or not the water then being delivered was corrosive. The nails remained in the water for several days but since no further rusting took place, it proved that our corrective treatment had eliminated trouble from that source, and these conclusions heralded the birth of "Wire Nail Chemistry," which later became the subject of an editorial in this magazine.

By the editor, this writer was dubbed a "Wire-Nail Chemist" in an appreciated manner of giving credit for practicality of the method of controlling treatment.

Obviously, we had to look elsewhere for the cause of our trouble. An analysis of the raw-water from the

Rappahannock River was made, and much to our surprise, found that it contained from 0.3 to 0.5 p.p.m. of iron. The conventional methods of coagulation, which we were using, produced a filtered water of zero turbidity, but did not remove the iron, consequently it went through the filters in solution, not being equipped to oxidize this ferrous iron by prechlorination, it became necessary to resort to an unconventional method of forming a floc. Prior to this time, hydrated lime was added to the raw-water only to supplement deficiencies in alkalinity needed for the formation of the floc with alum. In this experimental treatment the pH of the raw water was raised to 9.7 with hydrated lime, thus converting the soluble ferrous iron to the insoluble ferric hydroxide, which precipitated with the alum floc in the basins or was caught on the filter beds. This excess lime treatment naturally raised the optimum far beyond the range for forming coagulation with alum, therefore in order to bring the water back to a pH of 6.8, it was necessary to use larger quantities of alum than when turbidity was more or less the governing factor in calculating dosages. In other words excess alum had to be used as an acidifier. The writer admits that this method was somewhat expensive, but it produced results that eliminated red-water complaints, and kept the factory from transferring their shrinking department to Baltimore, a transfer that would have deprived 70 local people of their jobs. Some time later complaints were received from this same factory that stains showed up on some batches of linen but not on others. Investigation proved that this was due to a certain kind of sizing on the cloth and not caused directly by the water, therefore they were advised to leave all sizing out of cloth which had to be shrunk. Since these corrective measures were instituted seven years ago, we have experienced no further trouble from that source.

Ejectors

In feeding activated carbon, and alum which contains a high percentage of insolubles, the practice in many places has been to install an ejector in the solution line, and the Pemberthy No. 4 Ejector has generally been recommended. This particular ejector was originally designed for use where steam is available for pressure. It is made up of several small removable parts, consisting of a steam-jet, delivery-jet, tail-pipe and strainer if desired. The writer's experience has been that these small parts tend to clog, due to the resistance they offer to the passage of the more or less concentrated chemical solutions, necessitating frequent dismantling and cleaning. Substituting a No. 64 Pemberthy Hydraulic Ejector, designed for use where pressure is supplied from a water line and having the same connection dimensions as the No. 4, eliminated the clogging worries, presumably because the hydraulic ejector is free of small internal parts.

Hard Spots in Filters

Some of our filters have hard spots, or they might be more specifically termed "dead areas." These are not caused by improperly coagulated water, but rather are the result of a contractor's ignorance and an inspecting engineer's negligence. Instead of placing his gravel carefully, this contractor allowed the gravel to be dumped from wheelbarrows directly down on the underdrains from the tops of the filter boxes, the obvious result being broken laterals and an uneven distribution of the wash water causing the shifting of the gravel layers. Our water demand is so great that we cannot spare a filter out of service long enough to make the necessary repairs, neither can we risk allowing these dead areas to grow in size to reduce filter outputs, to say nothing of becoming breeding havens for "bugs."

Again, necessity becomes the mother of invention, and I herewith present specifications of a gadget which I have dubbed, "The Hard Spot Breaker Upper." A three-foot length of ¾-inch black iron pipe is brazed to a regular nozzle which will fit a two-inch hose. In the opposite end of the ¾-inch pipe, an old discarded ¾-inch countersinking drill is welded. This pointed tip facilitates pushing the pipe down into the compacted sand. Just above this welded prong, a series of staggered 1/16-inch holes are drilled in the pipe for a distance of 16 inches. When your gadget is finished, screw the nozzle to the business end of a two-inch hose, thrust the prong into the sand, turn on the water, and watch your hard spots literally dissolve. This is of course done during the regular filter washing operation. The device can also be used for a surface wash.

Dubious Complaints

Not all of the complaints which come in are justified. Investigation very often proves that those who make the complaints are merely taking the line of least resistance which, naturally, is to blame their troubles on the water. Bottling works making soft drinks, and ice plants are apt to be nuisances in this respect.

When such complaints are made, you can of course, stand your ground, assuring them that your plant effluent is in correct chemical balance, therefore the trouble cannot be laid at your door. However, I can assure you that Mr. Bottling Man will not be at all impressed with your scholarly defense of your product. When you've finished he will look at you, scratch his head, and say, "Mebbe yer right, mister, but I still got sody-pop machines that ain't a poppin' like they oughter."

The shortest distance between two points is a straight line, and in this instance that straight line should take you direcly to his plant. You may not know a thing about the beverage business, but the chances are that you will before you leave. You'll discover that they use machines, and that men are supposed to look after these machines occasionally. To even suggest that the trouble might be with the machines is an insult, "No, sir, they're the best money can buy and are checked over regularly????" After that statement, you are tempted to quote Bobby Burns, but if you've read your Dale Carnegie on "How to Make Folks Like You" you will understand why silence is golden at this point. Rather you should suddenly become interested in how this gadget works, what attention it takes to keep it working, etc., but remember that you're supposed to act dumb, you're mighty interested but for the life of you, you just can't visualize how the darned thing looks inside. Ten to one Mr. Bottling Man will take the head off from the carbonating machine to show you how it works, or rather how it did work before your city water put it out of order. Off comes the head, when lo and behold, he discovers that the carbonating nozzle and feed pipe has corroded. Of course he's flabbergasted, for this is just one of those things that couldn't happen. Inasmuch as it would be bad psychology to adopt an "I told you so attitude at this point," you congratulate him on his being able to locate the trouble for himself and that your being there was only incidental. Since you haven't done anything to ruffle his tail-feathers he very likely won't resent your telling him that you too have had your troubles with CO_2 gas eating away important little gadgets in your plant, so why not replace them with

carbonizers made of copper, brass or bronze. He must have been in the mood for suggestions, because you end up by coming home with a case of soft drinks—and with his "compliments." That headache is cured, and maybe you get a stomachache instead.

In the case of the ice plant, the same technique was used to discover that their troubles were caused by a pressure filter which they had not washed in three years. They went through the washing motions every day, but due to ignorance in operating the valves, I found that they were merely by-passing the wash water instead of shooting up through the filter bed. You can well imagine what came out of that filter when the wash water was directed into the proper channels. After washing it thoroughly, I had them put it out of service altogether, thereby eliminating the human error involved. This filter had been installed before the advent of the Fredericksburg Filtration Plant, and it was easy to convince them that their filter was no longer needed. Result . . . "No more complaints from the Ice Man."

Conclusion

In conclusion, the writer is happy to report that plans for a new addition, and a complete revamping of the old plant are under way. The new plant will be equipped with a new and larger laboratory, mechanical flocculators, prechlorination and ammoniation, and many other modern devices which aid the waterworks man to produce an effluent *"sans tache."* When this plant is put into operation, the writer trusts that he will be able to contribute to these pages, data that will prove of greater interest and value.

▼

ELECTRICAL PIPE THAWING

Some Considerations When Employing Arc-Welding Generators

By F. J. Hirner,

Harnischfeger Corporation, Milwaukee, Wis.

ONLY a few years ago was the arc welding generator employed for the first time in pipe thawing. Today many city water departments, plumbing contractors, as well as welding shops themselves, are finding this an exceptionally good method for freeing the pipes of ice quickly and economically. Here are some suggestions for building your own unit and the procedure to follow.

What Generator to Use?

Any standard welding generator may be used for this purpose, without alteration. Rugged construction, ease of operation, simple control and wide range of adaptability all tend to make the present day welder ideal for this application. A gasoline-driven model welder is generally used because it is independent of electrical power facilities.

The method of thawing frozen water pipes by a flow of electrical current through the pipe has many advantages. The pipe is heated because of the resistance it imposes to the flow of the current. This eliminates the old, more expensive and slow methods of thawing pipes.

Principle

The pipe is warmed by the electrical energy being dissipated in the form of heat. Every form of metal which conducts electricity nevertheless offers some resistance to the flow of electrical current. This resistance causes a loss of electrical pressure (voltage) in pumping the current through the circuit. In mathematical terms, it is this loss of voltage times the current flowing which gives a product of watts of electrical energy converted to heat during its passage through the pipes. The higher the resistance of the pipe walls and the stronger the current flow the more rapid the heat production.

Procedure

As to polarity, it makes no difference how the positive and negative lead wires are connected with respect to the pipe, but where water mains are involved, it is generally possible to connect the lead wires to fire plugs, curb service cocks and other similar points.

In the case of house service pipes, connection may be made to each side of the frozen pipe section so that the frozen part forms a part of the current circuit. Then boost the current indicator so that sufficient amperage passes through the frozen pipes.

Amperages

It is not possible to state the exact current (amperes) and time required to thaw a given length of pipe. The type and size of pipe determine the maximum amperage that may be used. It is well to bear in mind that a lead pipe will melt at much lower temperature than a corresponding size of copper or iron pipe.

The condition of the soil, location of the pipe, extent of the freeze, the temperature of the air, the type and size of pipe, kind of joint and amount of current; all are factors determining the time required to thaw. However, the following table is indicative of current practice.

Size of Pipe (Inches)	Recommended Current in Amperes	Approximate Minutes to Thaw
¼	70	14
½	120	21
¾	210	19
1	220	28
1½	300	31
2	340	39
3	410	58
4	500	74
6	500	118

Cautions to Remember

Use welding cable of a size at least equal to that used for a similar current in arc welding. Care should be exercised to select cable of ample size, as otherwise, considerable energy will be wasted by heating the cables. If long cables are used, this is very important. Make all cable connections to generator and pipe as tight as possible and see that all rust, grease, scale, etc., are cleaned off the pipe at the point of connection with the cables. Connect the cables as close to the frozen spot as possible. In other words, have as little excess pipe in a circuit as possible. Pass no current through the water meter. Check the gas pipe system to make sure that its pipes are not in contact with the water pipes. When thawing pipes in a residence or building, first open the house lead-in electric service switch to prevent the possibility of a short circuit or some similar complication. It is also advisable to disconnect the radio ground wire, if connected to the water pipes.

The method described here is to give a general idea of the application of arc welders to an ever-increasing use—pipe thawing. It is a safe, efficient and economical way of meeting what heretofore was an unpleasant and costly situation. Naturally, the proceedings will have to be altered somewhat to meet the needs of each individual case.

SOUTHWEST SECTION ENJOYS RECORD CONVENTION

The Water Department's Spiffy Offices. Are located in this unit of Oklahoma City's new and praiseworthy Civic Center.

All Because Oklahoma City Had What It Took

THE Southwest Section of the American Water Works Association (organized as the Southwest Water Works Association in 1912, became a Section of A.W.W.A. in 1934) held its 27th Annual Convention October 17th-20th in Oklahoma City. The official registration was 401.

Officers of the Southwest Section knew what was to be expected when Oklahoma City's bid for the 1938 convention was accepted, for the local committee put on the most successful of the Southwest conventions held in Oklahoma City, to maintain its reputation in a brilliant manner. The local Committee, headed by M. B. Cunningham, local superintendent of water and sewerage and aided by the Chamber of Commerce, had done the finest piece of publicity work in connection with a water works convention that has ever come to the attention of this writer. The attendance record, of better than 400, thoroughly proved the effectiveness of the campaign. Everyone came already sold on the fact that the 1938 Convention was to be a success; and, it was this spirit which helped make it so, thus proving the worth of pre-convention publicity and "go-getting" convention and program committees. In the 27th Convention of the S. W. Association, Oklahoma City had something to be proud of. There was never a dull moment and the record attendance at the technical sessions of a Southwest Convention bespoke the quality of program material.

Entertainment "Tops"

The entertainment was brilliant throughout, with entertainers of top class and a dance orchestra of repute. To a dinner party, followed by a Jessica Dragonette concert went the ladies while the stags were taken to a rough and ready buffet supper with plenty of beans and beer, and wrestling and boxing matches with plenty of go and punch.

Returning to the hotel visitors saw an unscheduled and amazing sight. It was in truth a "blizzard of bugs" —little bugs and big bugs that one of the much respected "Northers" of the Southwest Country blew into town before it while the thermometer's mercury was taking a nose dive. However, a group of us went to eat fresh figs from the Rio Grande Valley, swimming in Oklahoma cream, and marvelled at the sights of lighted store windows which couldn't be seen through because of the fluttering bugs and moths trying to find a warm spot. In the morning they had vanished, but the streets and sidewalks were somewhat crunchy under foot, when we went out for a return engagement with more figs and cream and "waffles-supreme."

The Convention closed with the Annual Dinner and Dance put on by the Manufacturers' Association.

Fuller Award to Weisse

At the dinner F. W. E. Weisse of Corpus Christi, Texas, was announced as the member selected to receive the George W. Fuller Award for 1938. Mr. Weisse was cited for his several contributions to better metering practices, with emphasis on his work in simplifying water meter registers, upon which he reported before the 1938 Convention of A.W.W.A. On the subject of "Selecting and Maintaining Meters," Mr. Weisse delivered another meaty paper in Oklahoma City, a digest of which is to be found later in this report.

Three Presidents

Retiring—Thos. L. Amiss, Supt. Water & Sewerage, Shreveport, La.
Pres. of A.W.W.A.—Reeves J. Newsom, Cons. Engineer, New York.
Incoming—Albert R. Davis, Supt. Water Dept., Austin, Tex.

Officers Named

Chairman—Albert R. Davis, Supt. Water Dept., Austin, Texas.

Vice-Chairman—M. B. Cunningham, Supt. Water Dept., Oklahoma City.

Secy.-Treas.—L. A. Quigley, Supt. Water Dept., Fort Worth, Texas.

A.W.W.A. Director*—Geo. B. Rohan, Supt. Water Dept., Waco, Texas.

*Succeeds John B. Winder, of Dallas, whose 3 year term expires with the close of the 1939 Convention of A.W.W.A.

Trustees—W. F. McMurry, Supt., Tulsa, Okla.; A. M. Brennecke, Supt., Denison, Tex.; A. F. Theard, Chief Engr. Sewerage and Water Board, New Orleans; J. H. Montgomery, Little Rock, Ark.

President Newsom Speaks

A.W.W.A.'s President, Reeves J. Newsom, former president of the Community Water Service System and now conducting a consulting practice, came down from New York to deliver the best speech of any made during his administration. To tell Southwesterners what

Geo. Rohan, Supt. of Water, Waco, Texas (New National Director-Elect.)

Frank W. Weisse, Supt. Meters Central Power & Light Co. (To Him Went the Fuller Award)

A.W.W.A. is doing, and proposes doing. Then, in a straight from the shoulder manner, he pointed out that Southwest water works men were not putting their shoulder to the wheel when it came to doing their part toward improving the status of the profession and the standing of the water utility executive in his community. Astonishingly true, he deplored the fact that out of 3,000 municipalities in the four states represented only 28 were represented by some form of membership in the Southwest Section, and that didn't seem to be toting fair with other sections of the country.

High-Lights of the Program

Amongst the high-lights of the technical program the "Afternoon of Electricity," which should have been a three day short course in itself; the "Symposium on Fluorosis," the paper on the "Maintenance of Water Meters" presented by the member voted the coveted Geo. W. Fuller Memorial Award, and that by M. B. Cunningham, revealing interesting features and developments in the Oklahoma City Water Works, stood out.

Technical Sessions

CHAIRMAN THOS. L. AMISS, Presiding

Opened with an invocation, followed with brief addresses by Mayor Frank Martin and City Manager W. A. Quinn, the first technical paper was that of M. B. Cunningham, Supt. of the Oklahoma City Water Dept., which briefly sketched the water supply facilities of the city, involving a water softening plant of 16 m.g.d. capacity at which two new developments were of exceptional interest. The first was the recovery of lime from sludge. This involved vacuum filtration, followed by drying and filter cake calcining in a multi-hearth Nichols-Herreshoff furnace. Perhaps the more sensational development, now already installed on a full plant scale, was the novel recarbonation scheme involving gas burning with under-water jets, thus eliminating cooling, scrubbing and compressing corrosive stack gases, often lean in carbon dioxide content. For these two, and also earlier developments of note, to L. H. Scott, Supt. of Purification, went the credit. In softening, and coagulation with chlorinated scrap iron, costs of treatment have been reduced from $14.00 per million to the present cost of $6.00, which happened to be the same as the power cost for pumping. By consistent and continuous water waste surveys, only 5 per cent of the water pumped remained unaccounted for. In valve maintenance, all larger than 8 inch were given semi-annual inspection, smaller sizes yearly. In fire hydrant inspection routine, the recommendations of the Fire Underwriters were followed. A proposed major project, under PWA, entailed a new storage reservoir with an independent treatment plant and pump station.

"Selecting and Maintaining Water Meters"—by F. W. E. WEISSE, Supt. of Meters, Central Power and Light Co., Corpus Christi, Texas.

Mr. Weisse's meaty paper had as its background the author's experience in connection with 26 systems operated by his company, covering a 66,000 sq. mi. area. In emphasizing the importance of proper selection of meters, quality of waters had proved the criterion. He cited case histories to show that the disc meter had been most satisfactory with some waters, whereas the piston meter had been so with others. Where neither had proved satisfactory the turbine meter with greater clearances, and somewhat less accuracy on very low flows but sustained dependability, had proved best. Thus, all three types of service meters were being employed, there being no "best meter" for all conditions. In installation, his chief warning was to use every means to avoid putting pipe strain on the meter, particularly with waters of changing temperatures. Regarding maintenance, Mr. Weisse stated that with *truly* effective repairs the maintenance problem had become negligible.

Mr. Weisse roundly condemned fiber and leather washers in the meter coupling, having found 60 per cent of the troubles with meter-motors to be caused by these washers. The trouble lay in the fact that these washers act as an insulator causing electric current to jump the two gasketed connections and result in pitting where leaving the metal parts of the meter, to enter the water as the path of least resistance. This led Mr. Weisse also to roundly condemn the efforts being made to pre-

Committee Chairmen

Convention Management—M. B. Cunningham, Supt. Water & Sewerage, Oklahoma City.
Entertainment—Erie W. Sherman, Sherman Mach. Wks., Oklahoma City.
Exhibits—Fred Puckhaber, Wallace & Tiernan Co., Dallas.

vent grounding of house wiring systems to water pipes. What was *really needed,* he emphasized, was more and better grounding connections to the service pipes—not less of it as some had been advocating. Then, too, the elimination of all insulating obstructions to free current flow over pipes and mains—*not off of them,* as happens when grounding to ground-rods, or attempting to insulate meters, and the like. Mr. Weisse advocated a choice of two methods of insuring free current flow and minimum meter damage from so-called electrolysis

—(1) an electric "jumper-wire" around the meter; (2) the use of soft metal washers in setting meters, rather than fiber or leather. On his systems a copper-clad fiber washer (perforated to allow water to swell the fiber) had been found inexpensive and effective.

Concerning meter readers, Mr. Weisse said that a reader who was not also trained as a meter-inspector had no place in his organization. Bad condition reports by the inspector were preferable to complaints by the customer, and far less costly to the water purveyor.

Concerning repair work, Mr. Weisse said that only the registration test, subsequent to repair, would disclose the effectiveness of the overhauling job. If registration correction required by use of change gears amounts to more than 5 per cent on large flows their experience had indicated that such meters should be junked. Because of poor dependability in small registrations, a new meter would pay for itself usually within a year, under such conditions. Further; based on experience, any repaired meter which fails to give 98 per cent or better accuracy on the small flow check, indicates over gearing, poor motor performance, and soon a serious money losing unit in service. One final thought (and Mr. Weisse's motto) was "Do not consider what it costs to repair a given meter, but how well and how permanent the repairs; also how costly not to junk, when junking time arrives."

The What and Why of Electricity

"The What and Why of Electricity" proved to be a short course in electricity for the water works man, amplified by excellent and expensively arranged full-scale demonstrations on the stage. Here was a real highlight of the technical program, to which a full day could have been devoted profitably. The course was conducted by engineers of the Oklahoma Gas and Electric Co. under direction of DR. E. G. GREEN, O. G. & E.'s Director of Public Relations and Education, who presented the four lecturers—each covering a particular phase of the "Why of Electricity" in water works operation. Distributed, was a 97 page mimeographed text employed as the basis of the much condensed lectures and demonstrations, reported to have cost the utility company roughly $700 to prepare and put on for the benefit of the Southwest Section. The four lectures covered: (1) Electric Theory; (2) Motors and Motor Control; (3) Power Consumption and Load Factors; (4) Light and Lighting. Then, the closing feature proved to be a spectacular demonstration and pyrotechnic display, with tricky high-frequency current. Perhaps the most interesting demonstration, with considerable potential possibilities, involved wireless control of motors through radio transmission, pumping units being stopped and started at will by members in the audience given a simple looking box with buttons to push. The principle is the same as recently perfected for operating radio receivers from remote points.

Officers

S. W. Jour. Chairman—Egmont Smith, Neptune Meter Co., Dallas.
Sec'y-Treas.—L. A. Quigley, Supt. Water & Sewerage, Fort Worth.
Editor—Robert O. Gresham, S. W. Journal, Temple, Texas.

Since space is not available for full justice to the subjects covered by the individual lectures we must restrict this report to a sketchy outline. It is hoped that somewhere the 97 page text, distributed in mimeographed form, may appear in print for general distribution. In the meantime a limited number of copies may still be available for distribution by Oklahoma Gas & Electric Co.

[To those especially interested a request to the Public Relations Dept. of this company at Oklahoma City may yield a worthwhile return.—Ed.]

Past President, Program Comm., Trustee

The Past Pres.—H. E. Nunn, Supt. Water Distr., Van Buren, Ark.
The Program Comm.—L. H. Scott, Supt. of Filter., Oklahoma City; H. J. Darcey, State San. Engr., Oklahoma City. (And, the "Scott-Darcey Process" really produced the goods.)
The Trustee—R. W. Harding, Supt. Water Dept., San Antonio.

Dr. Green, in sequence, introduced the following speakers. A former President of the University of Oklahoma, as the saying goes, he certainly "knew his stuff," when it came to handling the program.

"Electric Theory"—by JOHN W. SHAWVER, Asst. Div. Supt., constituted a review of simple formulae and an explanation of the little understood meaning of "Power Factor." Also, suggestions as to how to correct poor and costly power factors with the proper use of condensers, was supported by a demonstration, involving water pumping under the corrected and uncorrected condition.

"Motors and Control"—by A. W. WALTON, Chief Protective Engr., involved discussion and suggestions pertaining to the care of motors, other electrical equipment, and also safety precautions. Demonstrations were made with overload protection devices such as thermal relays, overvoltage relays and contactors. The operation of modern remote control equipment and automatic pumping stations, such as recently installed in the Oklahoma City system (described in the May 1938 issue of WATER WORKS AND SEWERAGE) was discussed and demonstrated. Finally the "mystic wireless control" of motor pump units was demonstrated as having potentialities not yet realized. The principle involves transmission of weak radio waves, which actuate starting and stopping devices.

"Power Use and Waste"—by WAYNE A. DARDEN, Engr. in Charge of Industrial Municipal Sales, proved to be replete with enlightenment as to power use economy through efficiency check-ups and record keeping in connection with motorized units, particularly pumping units. Mr. Darden detailed a method of making such efficiency tests by emphasizing simple understandable procedures, requiring but little equipment. Data required

(1) J. D. Brown, Commissioner, and Cecil Harrison, Chief Engr., Public Utilities, Enid, Okla. (attending his 19th consecutive S. W. convention); (2) L. Bennett, Supt. of Water, and C. H. Edge, City Engr., Holderville, Okla.; (3) J. M. McLendon, City Mgr., Duncan, Okla., and M. L. Hough, Genl. Mgr., Darling Valve Co., Williamsport, Pa.; (4) Mayor A. B. Corder, former Water Supt., and J. C. Harris, for 9 years Supt. of Water, Electra, Tex. (boasts a $163,000 water works project in the making); (5) Supt. Walden and Mayor Sager from Hugo, Okla. (To Walden his boss turns over the "management" for duration of the convention.)

and calculations were carried out on the blackboard, and Mr. Darden offered the following simplified formula as sufficient for the purpose of keeping check records on efficiency trends of motor-pump units.

$$\text{Overall Efficiency} = \frac{\text{Total Pumping Head}}{318.5 \times \text{K.W.H. per 1000 gals.}}$$

Mr. Darden pointed out that it was not generally appreciated that an efficiency loss, as determined, in reality meant a considerably higher proportional increase in power consumed. Since the overall efficiency of the motor and pump unit had to be taken into consideration, he cited examples in which a 10 per cent efficiency drop in reality entailed better than an 18 per cent increase in power required. In other words, the observed drop divided by the *original* overall efficiency of the motor-pump unit would approximate the wasted power, whether due to obsolescence of equipment, tuberculated mains or other causes.

"Lighting Developments," by A. E. WARNER, Lighting Engineer, constituted a review of modern developments in electric lighting, involving improvements in reflector designs and especially the highly efficient fluorescent vapor lamps, involving the use of various chemicals and mercury vapor. The new "daylight" tubular lamps were demonstrated, showing a current consumption of only 25 per cent of that by modern filament lamps, producing the same lighting values. In reply to questions, he said that the new 1000 hour lamps were selling for $1.50 to $1.80 each; the sockets cost 40 cents each; the required transformer, $2.50 each.

O.G.E.'s "Dean and Faculty"

The Dean—Dr. E. G. Green (center), Education Director, Okla. Gas and Electric Co. The Faculty—W. A. Darden, Mgr., Industrial & Municipal Power Sales; A. E. Warner, Lighting Engr.; A. W. Walton, Chief Protective Engr.; John W. Shawver, Asst. Division Supt.

The "Afternoon in Electricity" closed with the spectacular demonstration and tricks with high frequency current—in short, man-made lightning, visible and otherwise. Then, properly followed the thunder—the "thunder" of applause, so richly deserved by those who contributed to the program.

A Day to Fluorosis and Fluoride Removal

Indicative of the importance of the fluoride problem in water supply, a full day was devoted to this topic, discussed by prominent medical authorities and chemists.

"Endemic Fluorosis," by DR. H. T. DEAN, U. S. Public Health Service, Washington, D. C.

Dr. Dean, who was a pioneer worker in tracing down the effects of fluorides on the condition and appearance of the teeth of children, and now an authority on this topic, opened the symposium by reviewing something of the history of fluorosis, its symptoms and effects. The discovery at Colorado Springs (1915), that fluoride content of water supplies was responsible, led to the abandonment of supplies showing amounts above the apparent safe figure of 1 p.p.m. of fluorine. However, the sad feature, which had appeared with time, was the fact that improved water supply had only protected children younger than 2 years of age, mottled teeth having appeared 8 years later in 80 to 100 per cent of those children using the old supplies for 2 years or longer. The most pronounced condition found had been in Bauxite, Ariz., where the well supply contained 14 p.p.m. F.; however, any amount above 6 p.p.m. F. had no additional significance. Displaying a map showing prevalence and distribution, the most widespread condition appeared in the Texas Panhandle; another bad spot was the Northwestern corner of Ohio. Other areas appeared fairly well distributed in deep well areas—surface supplies being essentially free from the trouble. Even the Atlantic coastal area south of Washington had experienced fluorosis troubles where well supplies are high in sodium salts.

Dr. Dean said that the solution until recently had been that of providing a new source of water, but more recently methods of fluoride removal had become available.

"Discussion by the Oklahoma Medical Association," by DR. E. S. LAIN, Oklahoma City, Okla.

Dr. Lain's discussion contained many interesting and, to the water works fraternity, new disclosures which proved that serious fluorosis reached the bones to produce poor posture, rickets, anemia and even sterility. The telltale mottled enamel unfortunately never fades and had ruined the appearance of otherwise beautiful girls, for life. The most serious cases on record cited by Dr. Lain came from industrial poisoning of workers in fluoride dusts or the fumes from acidulating phosphate rock rich in fluorides.

"Discussion from the Oklahoma Dental Association" was contributed by DR. WALTER J. NEWTON of Oklahoma City, who largely commented on the excellent work and publications of Dr. Dean.

In reply to questions as to whether fluoride toxemia was to be classed as a cumulative poisoning, such as lead produces, Dr. Dean replied that it was. As evidence, children drinking fluoride waters for 2 to 4 years and thereafter a fluoride free water would frequently develop fluorosis during the ensuing 8 years. The limits of time, with various fluoride concentrations, producing

fluorosis remained an unanswered question. Wells could sometimes be cased so as to eliminate the strongest fluoride waters. In a surface supply the maximum fluctuation in fluoride (Colorado Springs) had been 1.8 to 3 p.p.m. Dr. Dean again emphasized that the mottled teeth was only an indication of deeper effects from fluoride poisoning, and added that there were no authentic cases where high fluoride waters had failed to produce fluorosis, if all of the case history was known.

"The Removal of Fluorides," by JACK WYATT, City Chemist, Amarillo, Texas.

Presented by J. N. Hinyard, Mr. Wyatt's paper, in reviewing methods of fluoride removal, stated that it might be partially removed by heavy magnesium precipitation (93 p.p.m. or more m.g.) at pH 10.5, or by activated carbon at pH 8.3. Passing water through beds of activated alumina had been effective, but regeneration of the bed had been unsatisfactory.

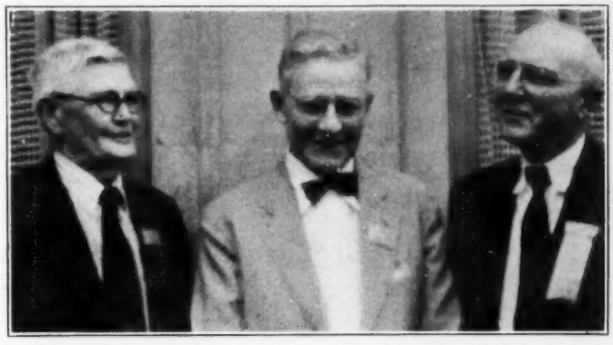
Now, what had promise of being the most effective and practical material, said Mr. Wyatt, seemed to be a specially prepared tri-calcium phosphate which had been supplied by International Filter Company under the trade name "Defluorite." Regeneration had been simply done with a 1 per cent caustic soda solution and 30 minutes' contact, followed by washing with plain water, and finished with carbonated water. An experimental installation at Amarillo had served to reveal the following facts: Each 1.3 cu. ft. of granular "Defluorite" had a safe capacity for 350 grains of fluorine (F) between regenerations. Applying a 5 p.p.m. fluorine water, the residual in the effluent had been 0.5 p.p.m. on the average. When new, 1.3 cu. ft. of "Defluorite" had removed better than 1100 grains between regenerations, but had gradually dropped to level off at 350 grains or somewhat better. Losses of the material had been made almost negligible with carbonated wash-water, prepared from dry-ice.

The plant contemplated for Amarillo would involve excess lime softening (10.5 pH), to precipitate magnesium and remove 3.5 of the 5 p.p.m. fluorine. After recarbonation to the original pH value, it would pass through "Defluorite" units. Sufficient untreated water would be bypassed to mix with the plant effluent to produce 100 p.p.m. hardness and 0.8 p.p.m. fluoride content.

In reply to the question of costs of "Defluorite" treatment, LAWRENCE CECIL of International Filter Co., stated that a figure of 1 cent per thousand gallons for each p.p.m. fluorine removed was about the quickest answer. The Amarillo scheme of combining softening and fluoride removal was the most economical. It has been estimated that removal of 240 p.p.m. hardness and 4 parts of fluorine would give a total operating cost of 2.5 to 3 cents per 1000 gals.

L. H. ENSLOW recalled that only a few years ago there was a loud cry for a satisfactory method of removing fluorine. Now that there appeared to be such, the cry was heard that it cost too much. In this interesting symposium there had been heard the dental and medical man, the chemist and the purveyor of equipment. The only thing lacking was the legal man to answer the question of liability of water works officials and municipal authorities who would knowingly serve a water which could result in life-time disfigurement of the appearance of those served. It seemed a strange situation that cost within reason should be considered a factor in a case of the sort. Now, with a method available, the courts would hardly excuse a management which may later be shown, through contributory negligence, to have been responsible for personal disfigurement of attractive young people for their life-time.

[See Judge Jeffrey on *"Municipal Liability"* later in this report.—Ed.]



Old-Timers and Past Presidents All

Walter Bennett ('17), *Barnsdall, Okla.*
Ed. A. Fowler ('31), *New Orleans, La.*
Jo. H. Paterson ('24), *Oklahoma City, Okla.*

"Methods of Testing for Fluorides," by DR. BASIL HAYES, Director of Laboratories, State Dept. of Health, Oklahoma City.

After reviewing and comparing earlier methods, Dr. Hayes offered an improved and simplified method, developed in the State Department of Health Laboratory, for determining fluorine content of water. Its chief advantage is that complete analysis is not necessary.

DR. O. N. SMITH, Head of Dept. of Chemistry, A. & M. College, Stillwater, Okla., in a discussion, stated that chemists still disagreed on a method for fluorine, that now carried in Standard Methods not being entirely satisfactory. Basically correct was the procedure of acidification and distillation off of the H_2SiF_6, for colorimetric measurement with zirconium alizirin sulphonate reagent. The latter, however, needed to be made up fresh every two or three days. The simplified Oklahoma Health Dept. Method was actually not harder than other procedures used daily by water chemists.

(1) H. S. Peck, Commissioner, Ft. Smith, Ark., and M. H. Collins, Rensselaer Valve Co., Louisville, Ky. (long a member of S. W. Journal Committee); (2) Frank C. Roe, Carborundum Co., Niagara Falls, and C. L. Smith, Supt. Sewage Works, Oklahoma City; (3) Guy Northrup, Hydraulic Development Co., New York City, and Charlie Becker, R. D. Woods Co., Philadelphia (a couple of city slickers who couldn't keep out of the pool-parlor across the street); (4) J. P. Recter, Supt., Norman, Okla., and Moultrie Smith, Supt., Nacogdoches, Miss.; (5) Lawrence Hough, V. P., Darling Valve Co., and W. F. McMurray, Engr.-Supt., Water and Sewerage, Tulsa, Okla.

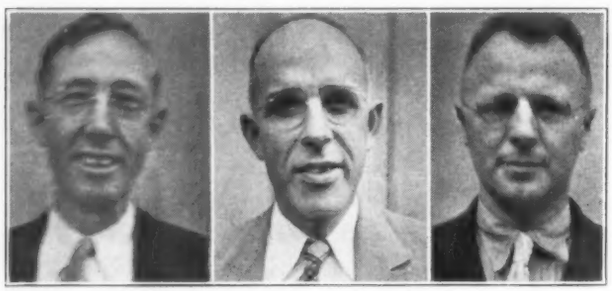
(1) W. J. Robertson and Frank Herman, two of Cunningham's capable engineers in the Oklahoma City Water Dept.; (2) Lawrence Cecil, International Filter Co. (Tulsa), and Percy Daniels, Supt. Water and Sewerage, Perry, Okla.; (3) F. Val Draube, Sec'y (Harrahan, La.), and J. W. Hodgson, Pres., East Jefferson Parish Water Distr., Southport, La.; (4) E. A. Rutledge, Rensselaer Valve's Development Engr., and Leadite's Hayes Kuhns (also a long way from home); (5) Jack Fugate, Engr. and Supt., Houston, Texas Water Dept., and A. B. Cole, Supt. Water & Sewage, Midland, Texas (with his 10 gal. topper and high-heel boots from West Texas).

Other Water Treatment Topics

L. A. JACKSON, Presiding

"Improvements and Developments in Coagulation and Sedimentation," by CHAS. H. SPAULDING, Supervising Chemist, Springfield, Ill.

Mr. Spaulding's paper was not far different from that which he had presented a few weeks earlier before the Ohio Conference on Water Purification—(see page 1063 of our November issue). After describing the three Springfield floating sludge precipitators, he pointed out that, while the economics of these clarifiers were for



Programmers

Prof. O. M. Smith, A. & M. College, Stillwater, Okla.
Chas. H. Spalding, Supt. Filtration, Springfield, Ill.
Dr. H. T. Dean, U. S. Public Health Service, Washington, D. C.

the largest part found in money and area saved in construction of tanks to provide between 45 min. and 1 hour retention after chemical application, as compared to 6 or 8 hours in conventional design. In addition, credit could be claimed for roughly a 10 per cent saving in softening chemicals, and a further saving of between 50 cents and $1.00 per m.g. treated, due to non-necessity of recarbonation. In the precipitator, 35 to 50 p.p.m. causticity had yielded results equal to between 70 and 80 p.p.m. in the conventional plant. In fact, as

"Brass-Hats"

A. M. Brennecke (Trustee), City Engr. and Supt., Dennison, Texas.
Dave Morey (Mfgrs. Comm.), Morey & Morey, Engrs., Dallas, Texas.
L. A. Jackson (Trustee), Supt. Water Dept., Little Rock, Ark.

little as 10 p.p.m. causticity seemed ample in precipitator operation.

Mr. Spaulding then revealed his experiences with bicarbonate of soda as a recarbonation agent in conventional plants, wherein the recarbonation basin and carbon dioxide equipment could be eliminted. With bicarbonate at $1.85 per hundred, the cost of neutralizing 10 parts of caustic alkalinity amounted to $1.20 per million only. Therefore, for the smaller plants and those not already equipped with carbon dioxide equipment, simple and fool-proof bicarbonate scheme was both technically and economically the correct method.

In addition to Springfield, Ill., points at which precipitators had been installed (or were being installed) included Minneapolis, as the largest, with 12 units of 10 m.g.d. capacity each. Others were at Baton Rouge, La.; Woodstock, Ill.; W. Jefferson, Ohio, and elsewhere.

[Note—A rounded out report, disclosing features of precipitation operations based on a year of operations and tests, is to appear shortly in this magazine.—Ed.]

"Water Supply for Railroads," by J. H. DAVIDSON, Water Supply Engr., M. K. & T. Ry., Parsons, Kansas.

Mr. Davidson introduced his topic by saying that it was the policy of railroads to purchase their water requirements from local water works whenever the price was not excessively out of line with cost of water production by the railroad. He then defined waters which would meet requirements for locomotive use and stated that it was common to find that railroad treatment plants had returned net savings of from 30 to 75 per cent of the initial investment each year. In some instances such savings paid for the plant in one year. It had even proved profitable to treat waters which contained as little as 2 to 5 grains of total hardness and less than 10 grains of dissolved solids. Therefore, most municipal waters had to be further treated before use in locomotives. Mr. Davidson felt that improved control of purification of many municipal waters, supplied industrial users, could be had with probable economies to the city. He cited the fact that even softened municipal supply had to be additionally treated for locomotive use and presented a case where a 4.5 grain hardness water from a municipal softening plant was, with profit, being reduced to 0.2 gr. hardness and 5 grains total alkalinity.

On the M.K.T. system, sodium aluminate has been used in lime-soda softening rather extensively. In some instances anti-foam compound was required to suppress foaming caused by high dissolved solids in the soft deep well waters of Texas, because of the high content of sodium salts. The railway water supply engineer also had the problem of producing waters for drinking, as well as satisfactory steam generation.

"Conditioning of Water for Power Production," by S. F. MAUNEY, JR., and CHAS. RICHARDSON, Carter Oil Company, Seminole, Okla.

Mr. Mauney stated that a characteristic average of water supply demand for oil refineries was 5 gals. per

(1) W. S. Mahlie, Supt. Filtration and Sewage Treatment, and Mrs. "W. S." from Fort Worth; (2) Professor C. E. Perkins of Oklahoma A. & M. College and three of his ranking seniors (from left), Ralph Lee, "The Prof.", Fred Victor, Grover Morris; (3) T. S. Fowler and J. H. Pryor, Supt. Water & Sewerage, Ada, Okla., with (center) Tom Simons, Southern Mgr., U. S. Pipe & Fdy. Co.; (4) in A. P. Jones' room was found a clever bar with some interesting folks sitting on the foot-rail; (5) Alex Bell—W. & T.'s Western Mgr., with Mrs. Schouten and hubby, Ernie, who works for Alex; (6) Neptune's Egmont Smith, with a vibrant lady whom he inveigled to leave New Orleans "for better or for worse."

gallon of gasoline produced. Principally used for still cooling most of the water was air cooled and recirculated. In a 36 m.g.d. recirculating system, 650,000 g.p.d. of make-up water was the average requirement. For corrosion control in recirculation systems, chromate salt (about 0.5 gr./gal.) was being added. For drilling rigs, water was softened in portable equipment by the fill and draw system, employing excess lime treatment (17 p.p.m. Ca $(OH)_2$ excess) to produce water of 50 p.p.m. or less total hardness. It had been estimated that for every pound of scale-forming material removed, 13 cents was saved in drilling. On this basis, water softening saved $2,000 per average well drilled. Some idea of the importance of cooling water to the oil industry was gained from the revelation that the Carter Oil Company, alone, pumped 460 million gallons daily.

Municipal and Criminal Liability

"Municipal and Criminal Liability," by A. L. JEFFREY, Municipal Counsellor, Oklahoma City, Okla.

Judge Jeffrey presented several citations of court opinions in various cases on record to emphasize his warning to officials of publicly owned utilities, that in damage suits it was not necessary for the plaintiff to prove criminal intent. It was merely necessary to show that negligence was contributory in the damages suffered. He went on to read other lengthy decisions, which held specially trained individuals, such as water works operators, especially liable for neglect in protecting the consumer. Because of the public faith in the ability of such specialists, their responsibility was doubly a real one in the eyes of courts or juries. In such an instance as discontinuance of any part of the purification processes, because of tastes and odors, could and would be held an inexcusable act. If death should result, in consequence, in the eyes of the law the matter becomes classed as culpable negligence. Therefore, warned Judge Jeffrey, water works operators had better equip themselves technically, and provide facilities which will make it unnecessary to take any chances with the safety or health of the public.

"Mobilization of City Facilities in Case of Major Disasters," by FIRE CHIEF MCALPINE, Oklahoma City.

In presenting a chart of action mapped for various city organizations in case of major disasters (mobilization and organization), Chief McAlpine emphasized the high importance of the public water supply, its continuity, and safety. He then asked water works managers whether they would be prepared; would the water department organization know instantly what to do—when and how to do what.

Concerning Cast Iron Pipe

"Specifications for the Laying of Cast Iron Pipes," by ALBERT R. DAVIS, Supt., Water Works, Austin, Tex.

With but brief discussion and explanation, Mr. Davis presented for distribution mimeographed copies of the "A.W.W.A. Specifications for the Laying of Cast Iron

S. Karl Bean, Supt. Distribution, Oklahoma City.
Judge A. L. Jeffrey, Municipal Counsellor, Oklahoma City.
Ernie V. Schouten, Dist. Mgr. for W. & T. Co., Okla. City.

Pipes," taken from the approved committee report as printed in the November, 1937, issue of the A.W.W.A. Journal.

The much traveled sound picture—**"Pipe and Public Welfare"**—a costly production of the Cast Iron Pipe Research Assn.—picturizing the well recognized and less well recognized values and attributes of cast iron pipe, was shown. In addition, its scientifically controlled production, to meet or exceed the specifications of A.W.W.A., was dovetailed into the dramatized story of cast iron pipes from Louis XIV up to the present.

Closing Session

In a brief "Business Session" on the closing day of the record establishing 27th Convention of the Southwest Association and Section of A.W.W.A., a mere handful of "regulars" listened to a brief acceptance

(1) John P. Harris, Ind. Chemical Sales, Chicago, and Lloyd C. Billings, Supt. of Filtration, Dallas; (2) Wesley Westmoreland, Jr., McWane C. I. Pipe Co., Dallas, and D. Y. McDowell, Supt., Malvern, Ark.; (3) Ed. Morey of Morey and Morey, and Fred Puckhaber, Texas Mgr., W. & T. Co., Dallas; (4) P. A. Templeton, Supt. Water & Sewerage, Poteau, Okla., and Henry E. Nunn, Supt., Van Buren, Ark.; (5) Wm. Higburg, Pres., Reilly Tar and Chem. Co., Indianapolis, and Wm. B. Connell, Southwest Distributor for Reilly.

(1) H. S. Peterson, Hays Mfg. Co., Erie, Pa. (in his Texas hat; (2) J. C. Clarke, Supt., Lubbock, Texas; (3) Carl Frederichs, W. & T. Co., Houston, Texas; (4) J. N. Hinyard, State Dept. Health, Austin, Texas; (5) Watt McCain, Mathieson Alkali, Tulsa; (6) J. E. Owen, Asst. Supt., Henderson, Texas; (7) Geo. H. Hoffman, Mueller Co., San Antonio; (8) O. D. DeHart, Pittsburgh Des Moines Steel Co., Dallas; (9) J. L. Fugate, Engr. and Supt., Water Dept., Houston, Texas.

speech from the new Chairman—Albert R. Davis; heard reports of the Secretary and Journal Committee; acted favorably on a bid from Dallas, Tex., for the 1939 convention; passed many resolutions on this and that; went home to catch up on some needed sleep.

Exhibitors

The following constitutes the list of 29 exhibiting firms, which, along with Exhibit Chairman Fred Puckhaber, and his lieutenants, Dave Morey and Egmont Smith, from the Section received a vote of commendation for the excellence of booth arrangements and display:

Atlas Mineral Products Co.
American Cast Iron Pipe Co.
Badger Meter Mfg. Co.
Birch Manufacturing Co.
Darling Valve & Mfg. Co.
Fred W. Hanks Co.
Hays Manufacturing Co.
Hersey Manufacturing Co.
Homelite Corp.
Industrial Chemical Sales
International Filter Co.
Johns-Manville Sales Corp.
Ludlow Valve Mfg. Co.
Mueller Co.
National Cast Iron Pipe Co.
National Meter Co.
National Water Main Cleaning Co.
Neptune Meter Co.
Pittsburgh Equitable Meter Co.
Reilly Tar and Chemical Corp.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
Southern Alkali Corp.
U. S. Pipe & Foundry Co., Wal.
Wallace & Tiernan Co.
R. D. Wood Co.
Worthington-Gamon Meter Co.
Water Works Engineering
Water Works & Sewerage

R. C. Hardcastle, Allied Equipment Co., Oklahoma City. (A real wheel-horse in handling the convention.)
J. Perry Moore, Director of Water, Houston.
Dr. Basil Hayes, Director State Labs., Oklahoma City.

WAS OUR FACE RED!

(A Correction)

On page 1041 of our November issue (Report of the N. Y. and New England Sewage Works Association Meeting) appears a candid-shot taken at the New Britain, Conn., Sewage Treatment Plant. A glib caption states, "Supt. John Szymanski being cross questioned by Frank Roe concerning 'Aloxite' diffuser tube service; by Ward Pitkin, concerning Oliver Filter performance at New Britain."

No sooner than copies of this issue had landed on the desks of readers did we hear about this "fox-paw." "Mr. Oliver" said that unfortunately those filters at New Britain were "Mr. Conkey's," and others told us that probably Filtration Equipment Corp. would be cancelling their WATER WORKS AND SEWERAGE advertising as the result of our supplanting their Conkey filters with Oliver's at New Britain. Well, we just can't afford anything like that, so we are running this correction, promptly.

The difficulty was that we had our dates mixed a bit, having just come from the Hartford plant where Olivers are installed. Next time maybe we'd better "snap-shot" the filters and not the conversationists.

▼

IT JUST COULD HAVE BEEN— SAYS GENTER

And here is another correction. This pertains to certain remarks by Al. Genter, daddy of sludge elutriation, in his discussion of the high cost of poor mixing arrangements in sludge dewatering on vacuum filters, before the New York and New England Sewage Works Associations. In reporting the gist of Mr. Genter's remarks we stated on page 1038 of our November issue that he pointed to the fact that "Faulty conditioning tank and piping arrangements at Washington, D. C., had cost the city $5,000 per year in additional chemical requirements, and slowing of filter rates."

Brother Al. snaps back—"Correction please! What I meant (and stated) was, that such faulty arrangements *could cost* a plant, the size of Washington's, $5,000 per year, for additional chemical requirements." Well, *our* "mixing device" seemed to work only too well at Hartford and New Britain and it could, and *did*, cost us this correction, all because Al. Genter (up front) didn't face about to the audience and "elutriate" as clearly as he usually does. We're glad to return Washington's $5,000, and to clear Mr. Genter.

WATER MAIN CLEANING*

Some Experiences and Results at New Rochelle, N. Y.

By E. T. CRANCH
New Rochelle Water Co.,
New Rochelle, N. Y.

The Author

EARLY in the spring of 1928, The New Rochelle Water Company first started the cleaning of mains. At that time one of the oldest thoroughfares in the City of New Rochelle was taken over by the County and made a County Highway. An 8-inch main had been laid in this road in 1886. Due to re-grading, it became necessary to cut and re-lay some of this pipe. It was found to be so badly choked with tuberculation, that it was considered advisable to clean the main before an expensive type of pavement was laid over it. A coefficient of 35 was found for this main before cleaning and 112 after cleaning. At this same time we also had about 10,000 feet of old 10-inch main cleaned. Since then mains have been cleaned at various times. The following table shows the number of feet of mains of various sizes that have been cleaned to date:

TOTAL OF MAINS CLEANED

Inch	*Feet*
4	6,120
6	16,540
8	18,980
10	31,700
12	19,700
16	6,370
24	12,000
	111,410

From this table it will be seen that approximately 21 miles of main have been cleaned. However, this is only about 8 per cent of our total mileage of approximately 250 miles.

Some Experiences

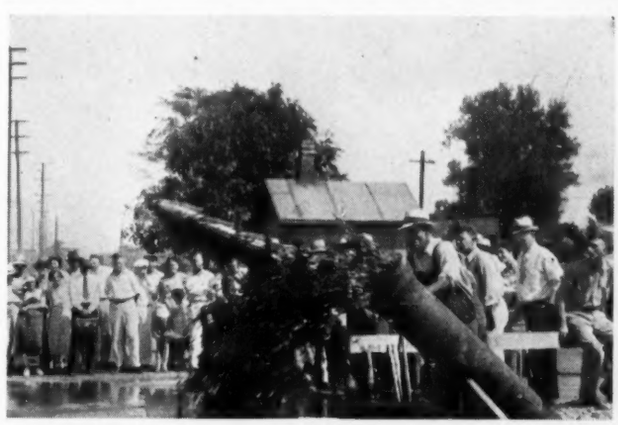
I assume that many of you have had your own experiences with the cleaning of mains, but perhaps you will still be interested in hearing some of ours.

First, we locate all services along the street to be cleaned, then see that the curb boxes are up to grade and the curb cocks in working order. This usually is not hard where we have only one main in the street. But in some cases we have two mains of different sizes laid almost side by side, and it does take some effort and time, then, to determine just which main each service is connected to.

The street is opened and the main uncovered at the beginning of and the end of the stretch to be cleaned. The length of the piece of pipe to be removed at the beginning of the stretch is determined. A piece of pipe is cut from stock this same length and the cleaning machine (so-called "rabbit") is inserted in this piece. The water in the main is then shut off and the curb cocks closed on each service. From this point on things are carried along as quickly as possible in order not to cause too great annoyance to the customers. All the customers have, of course, been notified in advance, and by this time many of them are usually out on the street watching operations. Two gangs are put to work cutting out the pipe at the beginning and end of the stretch. The piece of pipe containing the "rabbit" is inserted at the beginning of the line and an eighth bend, with a piece of pipe long enough to reach up to the surface of the ground, is caulked (with yarn only) onto the main at the end of the stretch. Men with ear phones are then stationed at all intermediate valves on the stretch to be cleaned in order to determine when the rabbit passes the valve. The water pressure is then turned on behind the rabbit. Usually the rabbit shoots right through and soon pops out of the other end, bringing with it tons of tubercles and dirt.

When the Rabbit Stops

If, however, the rabbit stops, then the fun begins. First, we usually try "bumping the rabbit." In this operation, the inlet valve is closed and all the water possible allowed to drain off. Then the valve is opened quickly. Sometimes this has to be done two or three times. This method is often successful, but, if not, then other means must be tried. If there is a hydrant near the inlet valve and another hydrant between the inlet valve and the spot where the rabbit is stuck, the Fire Department is called on for assistance. The inlet valve is closed and a pumper is connected between the two hydrants. The pressure is then raised until the rabbit starts moving, if it will. This method has also proven successful. But the facilities are not always there to put such a method into effect. If the rabbit still will not move, it then becomes necessary to dig it up. By means of the geophone, it is usually easy to determine its exact location. Sometimes we have found it wedged in the pipe with a log of wood or a pick handle. Sometimes caught on a defective lead joint, or stuck in a



The Rabbit in Mid Air
(An exceptionally good catch of the cleaning-machine emerging from the main.)

*This paper, presented before the N. Y. Section of A.W.W.A., is being published by permission of the Secretary and Editor of the Association.

Reading the Test Meter in Friction Coefficient Tests.

defective valve. If the type of fittings used in the line to be cleaned is known in advance, the rabbit can usually be so made up that it will pass an ordinary offset bend or eighth bend without difficulty. In such a case the rabbit is made a little shorter and the joints in it are left very flexible. But when the rabbit has been made up for a supposedly straight run of pipe, and then runs into an offset made up of eighth bends, we have found that it will stick.

Up to 1906, all service taps installed were equipped with so-called "eel traps." This consisted of a cast bronze screen, about one inch long, projecting beyond the end of the tap into the main. Dozens of these eel traps would come out of every main we cleaned. The rabbit has never stuck on them, but would shear them right off. The presence of these eel traps, however, probably accounted for some of the broken blades found on the rabbit when it came out of the pipe.

Dragging the Rabbit

The foregoing applies to the so-called "shooting" of mains, where the rabbit is forced through by water pressure. In the case of 4-inch mains, and very badly tuberculated 6-inch mains (or even 8-inch mains when the available pressure is low), it becomes necessary to drag the rabbit through the main by means of a windlass and cable. In this case a special make-up piece, which allows for the feeding of a light cable through it, is inserted at the beginning of the stretch to be cleaned. The water is turned on and a light cable with a float at the end is washed through the main. After this has come out at the end of the stretch the water is turned off and the light cable is attached to the heavy cable on the windlass set up at the end of the stretch. The special make-up piece is removed and the light cable, with the heavy cable attached, is then drawn back to the beginning. The rabbit is attached to the heavy cable, drawn into the pipe, a permanent make-up piece put in, the water turned on and the rabbit slowly dragged through, while the water flushes the loosened deposits ahead of it. This method of cleaning, while equally effective as "shooting," is slow and tedious. When dragging, lengths of not over 500 feet are usually the limit. In "shooting," a thousand or more feet of main may be cleaned in one operation. Sometimes it is found impossible to wash the light cable through with a float, and it becomes necessary to push it through with sewer rods.

Unfortunately we obtained no pictures of main cleaning operations in New Rochelle but I am indebted to the National Water Main Cleaning Co. for a few representative views of main cleaning.

[These views were lantern slides.—Ed.]

Tuberculation Control by Treatment

For a number of years we have experimented with the chemical control of water to prevent corrosion. We used to be troubled every winter with complaints of "red water" on dead ends. We then equipped our pumping plant for the application of soda ash. By raising the pH from 6.8 to about 8.0 we were successful in putting a stop to the "red water" complaints. As soda ash is a relatively expensive product to use and will not produce a coating to inhibit further corrosion we used it only during the period when "red water" complaints occurred, which would be two or three months during the middle of the winter. As more and more main cleaning was done we felt that something should be done to retard the re-appearance of tubercles in the cleaned mains. In the spring of 1936 we started the continuous treatment of our entire supply with hydrated lime, maintaining a pH of about 8.6. With only a few interruptions this treatment has been carried on continuously since then. In the course of this work it has been interesting to note that it takes about three days' time to build up the pH in some of the outlying territory of the distribution system. Also, when an interruption in treatment occurs, it takes about three days for the pH to drop in these outlying sections. Except for these tests I never would have thought that the movement of water in our distribution system was so slow.

We cleaned a number of mains in 1936 just as we were starting the lime treatment. We have had occasion to cut in large taps in some of these main with an A. P. Smith tapping machine, at intervals since then. From an examination of the taping discs removed these mains would appear to be in excellent condition. How-

The Manometer Set-Up in Friction Coefficient Tests.

ever, we have been unable to find any evidence of a lime deposit on these discs and, though slight, they have shown evidence of the beginning of some tuberculation.

Determining the Benefits

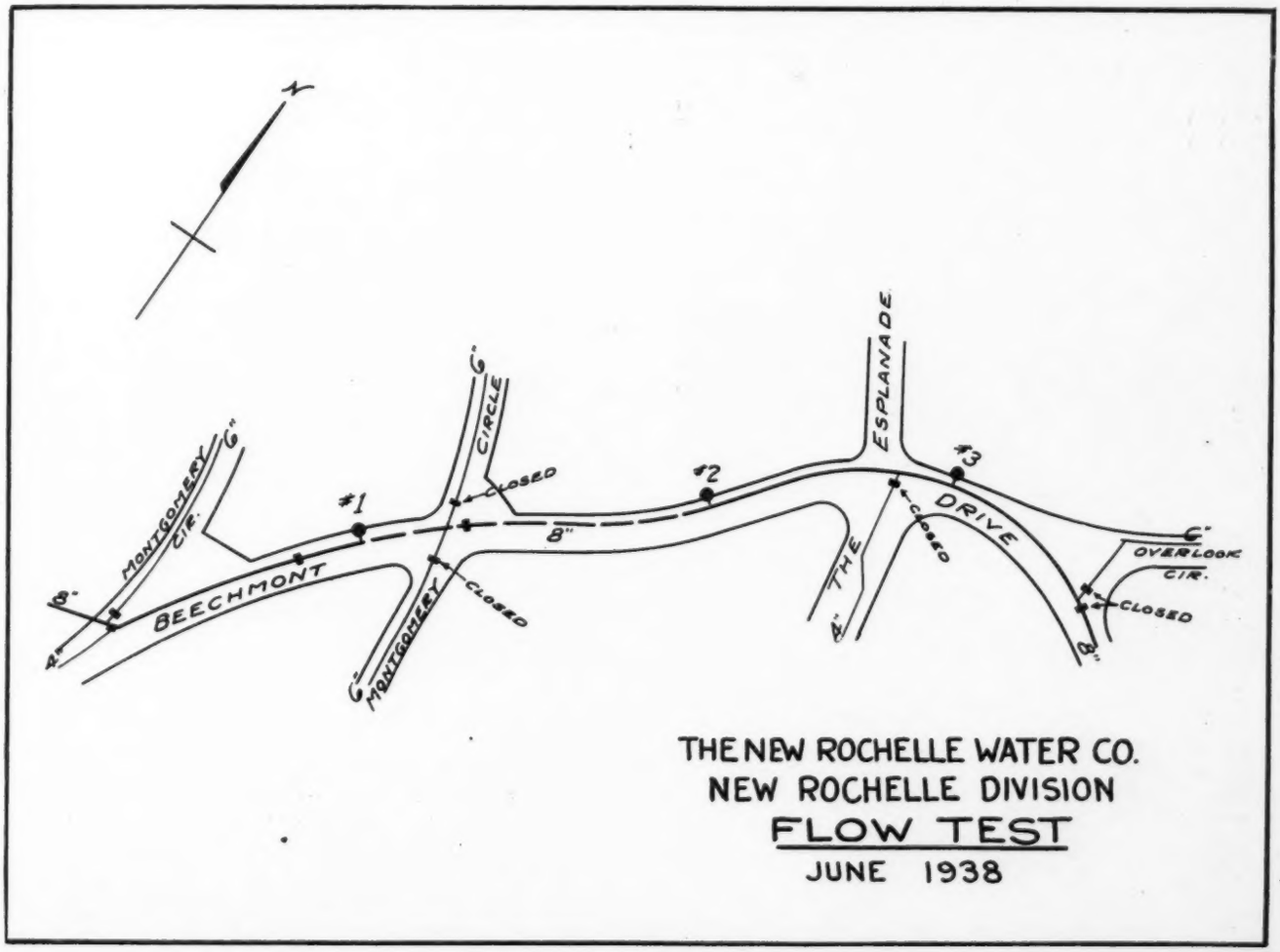
On most of the mains cleaned we made flow tests, before and after cleaning, to determine the coefficient of friction. On two of the mains cleaned in 1936 we have run periodic tests to determine how fast the coefficient is dropping. The method employed consists of inserting a Pitot tube in the section, to measure the flow of water during the test. Pressures are then recorded beyond at selected points, the distances between which is carefully measured.

The Pitometer is read every half minute for a period of thirty minutes and the pressure gauges are read every half minute during the same interval. These readings are averaged and such average values are used in figuring the coefficient. In order to secure sufficient velocity in the 24-inch main for test purposes it has been found necessary to cramp a valve on a parallel 20-inch main and induce a flow of 3 to 4 m.g.d. in the 24-inch. In this method of testing it is of course also necessary to obtain accurate elevations at the test gauges, and to carefully measure the distance between them. The gauges are also calibrated on a dead-weight gauge tester both before and after they are used. As a check, the coefficient of each section is calculated and then the coefficient for the whole stretch is determined. These values have always been reasonably close together.

Before cleaning, this particular main was found to have a coefficient of 62 and after cleaning 116. In two years this coefficient has dropped to 75. Most of this drop occurred in the first year, and the rate of drop for the second year has been very slight.

A Preferred Test Method

In connection with an 8-inch main the method of the testing used as indicated in the sketch, the valves being closed off as shown. By means of garden hose a manometer is connected up between hydrants No. 1 and No. 2. A three-inch test meter is then connected to hydrant No. 3 and tests are run at two different rates of flow. The accompanying pictures reveal the set-up of the manometer and the operation of the test-meter. You will note from the picture that a fish-trap is used before the test meter. When we first tested the mains after cleaning we found that there were a few loose tubercles which had not been flushed out of the main. After we had broken a couple of meter discs we decided it would be more economical to use a fish-trap. (It will also be noted that the device provides a very convenient seat for the operator.) This method of testing was suggested by the late Burt Hodgman of the National Water Main Cleaning Co. I feel that it gives a more accurate determination of the friction loss than does the method first described, where pressure gauges are used. In using the manometer it is also unnecessary to obtain elevations, such as are needed in connection with pressure gauge readings. In the manometer we use mercury, carbon tetrachloride, bromoform, or a combination of carbon tetrachloride, bromoform and



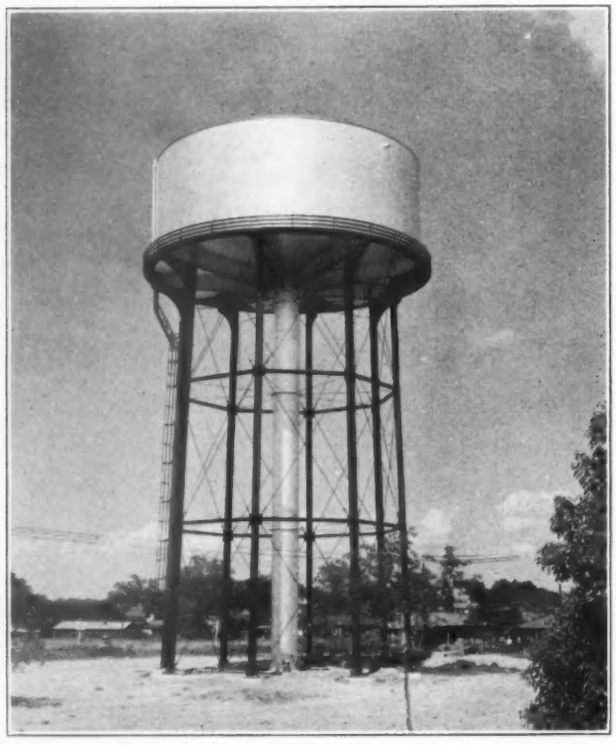
Sketch Illustrating the Method of Making Flow and Friction Tests on a Main.

Water Works and Sewerage—December, 1938

benzine, whichever will give us the greatest deflection within the range of the instrument. We also test each stretch at two different rates of flow. In this test the flow meter is read every minute and the manometer every half minute for a ten minute interval. The results of these readings are averaged and the average values are used in determining the coefficient.

The first method has the advantage of including a long stretch of main in the actual test, whereas the second method includes only a relatively short length of main in the actual test. In the case of the 8-inch main we found a coefficient of 36 before cleaning and 108 after cleaning. After two years that coefficient (108) has dropped to 69 and here again most of this loss occurred during the first year after cleaning.

From our experience we would say that it is possible to treat a soft water so that corrosion is retarded and "red water" corrected. However, there appears to be still more to be learned if tuberculation is to be entirely eliminated by some treatment of the water, which is to definitely prevent those small tubercules that seem to have an unexpected marked effect in lowering the coefficient of pipe lines.



"TRIM"

To us trim is the word for the appearance of this new tank at Baton Rouge, La. It is of radial-cone design, is 60½ feet in diameter, and the tower is 90 feet high. The lacey appearance of the tower design is not unlike the artistry in Louisiana's wrought iron architecture of bygone days. Hardly looks like a half-million gallon unit, but it is.

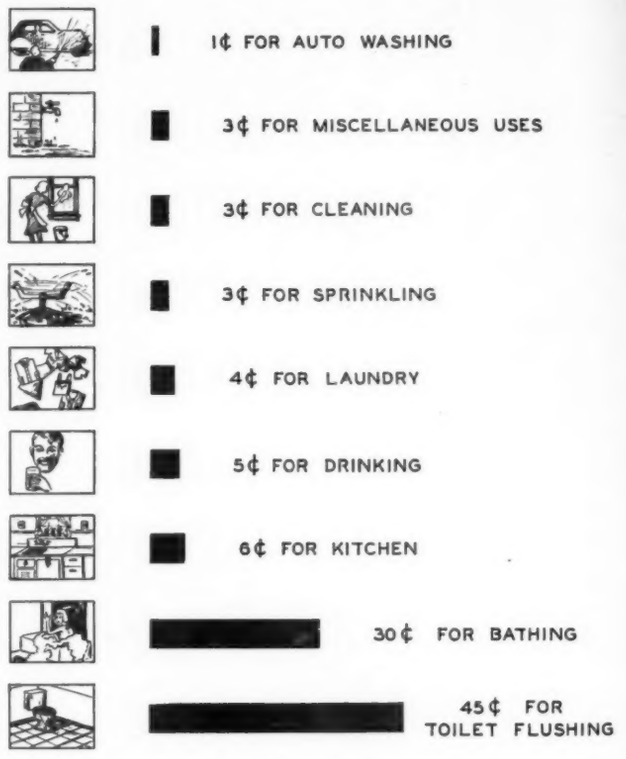
"SERVICE AND THE CONSUMER'S $"

Here is an interesting and enlightening chart taken from the 22nd Annual Report of the Springfield, Ill., Water Department.

It is based on a survey made by H. V. Pedersen, Water Supt., at Marshalltown, Ia., to determine what percentage of water in the average consumer's home goes for various uses.

The Springfield folks have taken these percentages and made them more real to the customer, by showing him that out of every dollar paid for water used it only

HOW YOU USUALLY DIVIDE YOUR WATER DOLLAR



cost him 1 cent to wash his car, only 4 cents for laundry work at home, 3 cents for sprinkling in summer. He, and also many water works men, may be surprised at such low figures in comparison with that for water used in operating the bathrooms of his home. And so, it is apparent that we are living in a *"Bath Room Civilization,"* only because public water supply makes it possible, at a cost within reach of the many.

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MUNICIPAL P.H. ENGINEERS FORM A CONFERENCE

A new organization known as "The Conference of Municipal Public Health Engineers" was formed during the 1938 meeting of the American Public Health Association, with the following officers chosen:

Chairman—Joel I. Connolly, Chicago, Illinois.
Vice-Chairman—Aime Cousineau, Montreal, Canada.
Secretary-Treasurer—Alfred H. Fletcher, Memphis, Tenn.

Executive Committee:

James L. Barron (Nassau County, L. I.); Arthur E. Gorman (Chicago); Henry C. Lane (Minneapolis); F. Gardner Legg (Detroit); Sol Pinus (New York City).

This new organization will provide a medium for an exchange of ideas relating to the problems of the municipal public health engineer, and effect cooperation to the mutual benefit of the Conference of State Sanitary Engineers, and the Engineering Section of the A.P.H.A. The first meeting will be held on Monday, one day immediately preceding the 1939 Convention of the American Public Health Association.

Engineers in health, water, industrial and similar related departments of municipalities and urban areas are eligible for membership.

THE DISPOSAL OF WASTE ACTIVATED SLUDGE

By A. J. FISCHER

The Dorr Company,
New York, N. Y.

THE activated sludge process of sewage treatment is at present in use in approximately two hundred and twenty plants in the United States. By far the most popular method of disposal of the excess activated sludge to render it inoffensive is by anaerobic digestion. In only sixteen plants, in fact, is the digestion step omitted.

The Author

Primary sedimenation ahead of the aeration step is employed in all but twenty of the two hundred and twenty plants, while both primary sedimentation and digestion are omitted in only eleven.

Waste activated sludge normally contains 99 to 98.5 per cent moisture. It is generally recognized that it is of advantage to decrease this moisture content prior to further handling in a digester or on a vacuum filter. The advantages of introducing a thickened sludge into a digester are that the digestion capacity, heat losses and volume of troublesome supernatant liquor will all be materially decreased. In vacuum filtration, the filter rate is increased and the chemical conditioning requirements decrease as the solids in the filter feed are increased. Other advantages are that the sizes of conditioning tanks, filtrate pumps, etc., that are required may be cut down.

Means of Thickening

To date, waste activated sludge has been thickened on a commercial scale by means of two well-known dewatering devices, the thickener (tank) and the centrifuge. There are at present five plants in operation or under construction, utilizing separate thickening tanks, while centrifugal machines will be used at two plants, one of which is in operation.

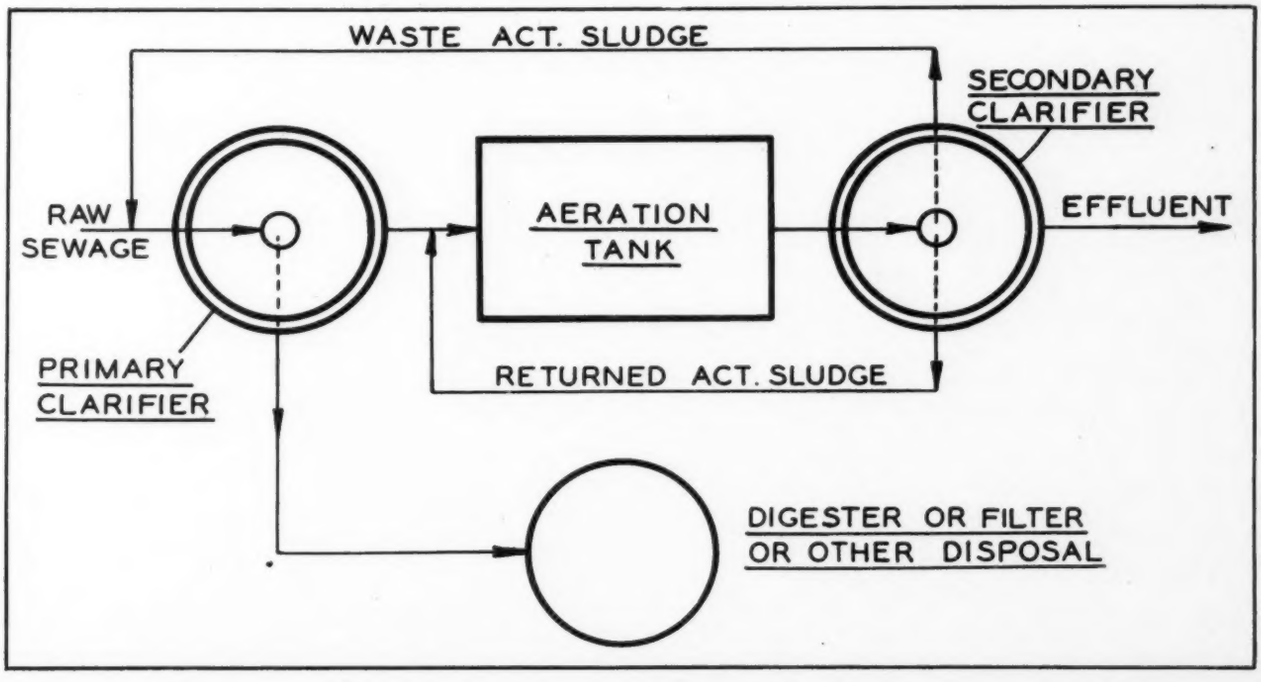
Where the aeration step is preceded by sedimentation to remove the coarser solids, the primary clarifier may be utilized to perform, to a considerable degree, the same function as the separate thickening tank. In this scheme all excess sludge is wasted to the inlet of the primary clarifier in accordance with the accompanying flow sheet.

It is conservatively estimated that this process is in use at more than a hundred plants out of a possible one hundred and eighty in operation at the present time.

The process is not a new one. It was first developed at the Essen-Rellinghausen plant of the Ruhr District in Germany. A United States patent application covering the process was filed by Dr. Imhoff in 1924, and issued as a patent in 1929. The Dorr Company, Inc., was licensed under this patent in 1936.

Advantages of Return Scheme

Besides assisting in consolidating the waste activated sludge at no added plant cost, this process has the ad-



Preferred Arrangement for the Disposal of Activated Sludge.

vantage of thoroughly mixing the primary and the activated sludge and so makes the combination more amenable to digestion or filtration.

Other advantages are: (1) The return of a well activated sludge to the raw sewage assists in keeping the sewage "fresh" and, thus, in reducing odor nuisances. (2) The return of the sludge ahead of the primary clarifier increases sedimentation efficiency, especially if the clarifier is preceded by a flocculator. (3) Plant operation is greatly simplified as the waste sludge may be continuously transferred to the raw sewage inlet by means of the same pump that returns part of the activated sludge as seed to the aeration unit. This affords a simpler control of the sludge in both the primary and the secondary clarifiers. (4) Installation and operation costs are naturally reduced.

Design Considerations

It is more or less standard practice to provide for a two-hour settling period based on average daily flow in pre-sedimentation tanks. This is adequate to settle the returned waste sludge provided the rate of return does not exceed about 10 to 15 g.p.m. per million gallons of sewage treated. This quantity may readily be split off the main sludge return flow by a branched line with suitable valve control or by means of weir box with an adjustable weir for the return sludge and an overflow for the waste sludge. Even if the sludge is wasted at an excessive rate so that some of the flocs overflow the primary clarifier effluent weir, no harm will result as the excess qnantity flowing to the aeration tank will be reactivated.

The question as to whether the waste sludge should be returned to the primary clarifier or thickened in separate tanks, or by centrifugal machines, has received considerable attention from engineers. In general, separate thickeners have been advocated only in relatively large plants and in extremely warm climates where there is danger of septic action occurring in the primary settling tank, with consequent floating of the sludge. Other cases are where the primary and the activated sludges are disposed of in a different manner. For example, where only the primary sludge is digested and both primary digested and undigested activated sludges are dewatered on vacuum filters.

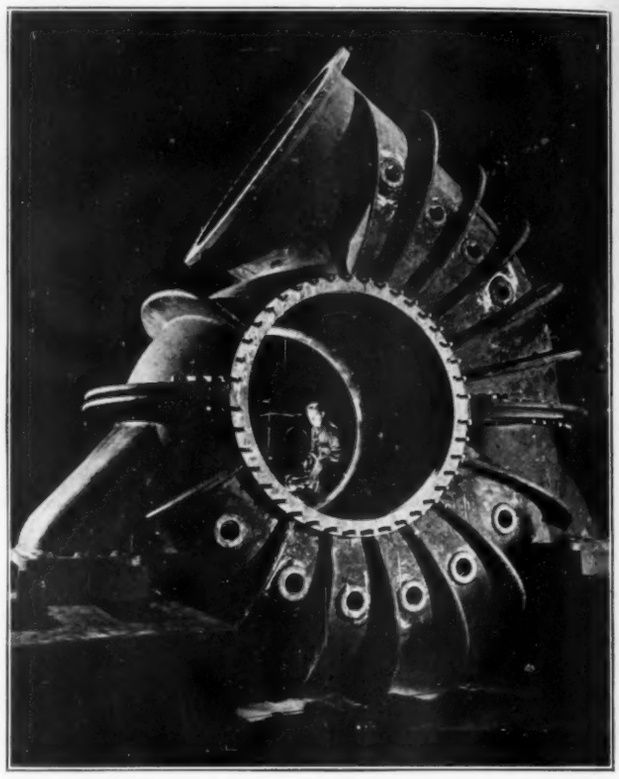
Choice of Method and Economic Considerations

Dewatering of activated sludge by means of centrifuges must still be regarded as being in the experimental stage. While it is true that notable advances in centrifugal machines have been made since the initial work at Milwaukee in 1921-1922, it has not yet been demonstrated that they can successfully compete with vacuum filters in producing a low moisture cake. Where centrifuges have been applied for partial dewatering ahead of digestion, it appears that they cannot compete either in installation costs or in operating costs against separate thickeners. The use of a separate thickener on the other hand entails an additional capital outlay as against using the primary clarifier to perform the dual function of settling the raw sewage and thickening the waste sludge.

The wasting of excess activated sludge to the primary clarifier is, therefore, not only the least expensive method of preparing it for further disposal, but is also the method that, by reason of its wide adoption, has proved to be satisfactory and foolproof.

"NIZE LI'L SNAIL"

If a fellow who had a nice snoot-full bumped into this thing, he wouldn't think he was seeing pink-elephants but he'd wonder, all right, what sort of "likker" he had beei drinking. Backing off he'd probably say, "Nize li'l snail; nize li'l snail."



This picture is of a spiral pump casing that is no watch-charm. It is all cast-iron and weighs 45,000 pounds in its "stocking feet." This striking photograph was sent us by Allis-Chalmers Mfg. Company of Milwaukee, in whose shop four of these "he-man" centrifugal pumps are under construction for the Chicago Sanitary District.

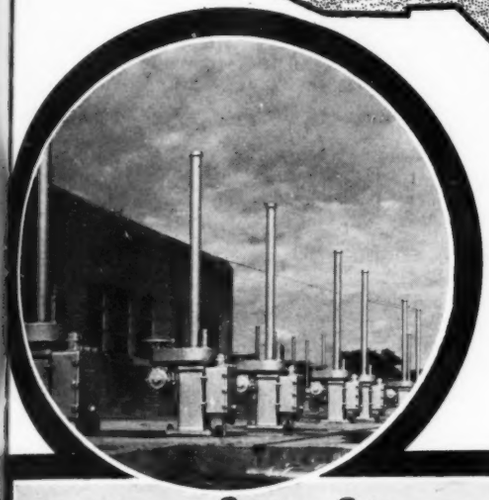
Completed, these 72 inch double suction motor-pump units will weigh 135,000 pounds each; will have capacities of 168,750 gals./min. each, against 19½ feet of head at full running speed of 138.5 revolutions per minute.

▼

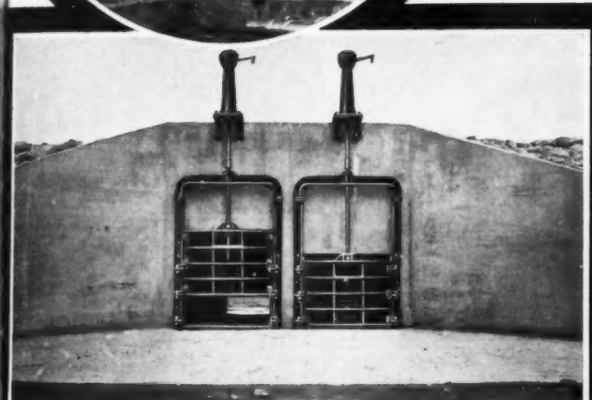
GALVANIC CORROSION STOPPED BY WATER TREATMENT

Experimental work under way by the Division of Sanitary Engineering of the Department of Public Health of Massachusetts is revealing that, in spite of corrective treatment of the water, galvanic action continues to occur in piping systems wherein dissimilar metals are brought together. Combinations of nine different kinds of service pipes (including those in common use today) have been immersed in raw surface and ground waters and in surface and ground waters treated to prevent corrosion. Results to date indicate that treatment with soda ash or lime has little or no effect on corrosion caused by galvanic action. Therefore, it is apparent that treatment of the water at the source is only effective in preventing corrosion at joints when a uniform kind of pipe is used in the distribution system and services. The conclusion is that anti-corrosion treatment does not prevent corrosion of services where pipes of dissimilar metals are used in contact with each other.

Nation-Wide Acceptance



A FEW OF MANY TYPICAL INSTAL-LATIONS



EASY INSTALLATION
EASY OPERATION
NEGLIGIBLE MAINTENANCE

The Nation-Wide acceptance by outstanding engineers and contractors of Mueller-Columbian Water Controlling Equipment is due to the reputation of these products for easy installation, easy operation and negligible maintenance. All parts of the standard sluice gates are carefully and accurately machined to templates and gauges, which assures interchangeability of parts. This permits easier installation in the field and greatly facilitates later repairs or replacements.

The Mueller-Columbian line is complete—many standard sizes, types and operating mechanisms are available that often materially reduce costs. Unusual or special equipment can be furnished upon specification and all Mueller-Columbian products have the benefit of specialized plant facilites and many years of engineering experience in all phases of water control projects.

Mueller plant and engineering facilities are at your service to help you plan or design any water control project. Take advantage of this specialized experience. Data on service, products and costs will be cheerfully submitted.

NOTHING TAKES THE PLACE OF LIGHT

NOTHING TAKES THE PLACE OF CAST IRON PIPE

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

Laying 36" Cast Iron Pipe at Lynchburg, Va. — part of a 22-mile water transmission main.

IN the olden days, when the first cast iron underground main was installed, men read by the light from a candle or from oil burning in a shallow vessel. A century later came the lamp chimney, followed by other improvements in artificial lighting, most of which are now obsolete. Yet that first cast iron main is still in service and cast iron pipe, essentially the same material as in 1664, is today the recognized standard for underground mains. Nothing has taken its place. A pipe material must meet 10 requirements for long life and economical service. Some materials meet some of these requirements but only cast iron pipe meets them all.

CAST Q IRON

Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

THANKS a million . . .

MUSICALLY SPEAKING we may not be much on the "Harmony stuff" but we just can't help raising our voices in sincere appreciation to all our associates for their willing and friendly cooperation.

IN LOOKING BACKWARD we hope that we have contributed in some small measure, something towards making your daily tasks easier and more enjoyable.

ON LOOKING FORWARD we hope that we shall continue to be considered as friends and counselors in our future relationships.

Merry Christmas and a Happy New Year

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Recent Air View of Barberton Plant, THE COLUMBIA ALKALI CORPORATION

Through The Centuries With Alkalies...

TWENTIETH CENTURY

IN this concluding chapter of a series tracing the part which alkalies have played through the ages in the development of many industries, it seems fitting to picture the present Barberton plant of THE COLUMBIA ALKALI CORPORATION as an example of current achievement in alkali production. Here modern science has made possible the manufacture of Soda Ash, Caustic Soda, Sodium Bicarbonate, Modified Sodas, Liquid Chlorine and Calcium Chloride in quantities and quality undreamed of a few decades ago.

COLUMBIA

SODA ASH
CAUSTIC SODA
SODIUM BICARBONATE
MODIFIED SODAS
LIQUID CHLORINE
CALCIUM CHLORIDE

THE COLUMBIA ALKALI CORPORATION

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BOSTON
CINCINNATI
PHILADELPHIA

"THE WORLD DO MOVE"

Wherein We Learn of an Advance in Pipe Jointing

By D. R. TAYLOR
Plant Superintendent, Roanoke Water Department, Roanoke, Virginia

The Author

IN by-gone years, during the days of the early settlers, when it required forty days to cross a state and when groups of people blazed a trail to the headwaters of a stream to settle there, life was what the modern generation would call dull; yet we proudly expand our chest when we read in histories of such activities of our ancestors and refer to them very proudly as pioneers.

In this modernistic age with radio, streamlining, air-conditioning, and heavy-water, the rapid discoveries and amazing inventions arouse, at most, but mild interest. In spite of the fact that long whiskers and covered wagons are in the minority, we still "pioneer" daily even in the waterworks profession; however, without the attendant hardships experienced by our forefathers.

A Big Springs Starts a City

The city of Roanoke, Virginia, began its existence in 1834 as the town of "Big Lick." It nestles in the Valley of Virginia between the Allegheny and the Blue Ridge Mountains and along the banks of the Roanoke River, fed by the big spring which was a chief reason for the settlement of "Big Lick"—an important cattle center.

Roanoke's water system began as a subsidiary of a land developing company, installed to lend attractiveness and enhance the value of the property to be sold. During its early years, under several different ownerships, the system grew like "Topsy" with little or no particular plan for the future. Beginning in 1915, improvements were made in accordance with a more orderly plan; and in 1931, nationally known consulting engineers were engaged to make a thorough survey and to construct a long-time comprehensive plan to be followed in future improvements and betterments.

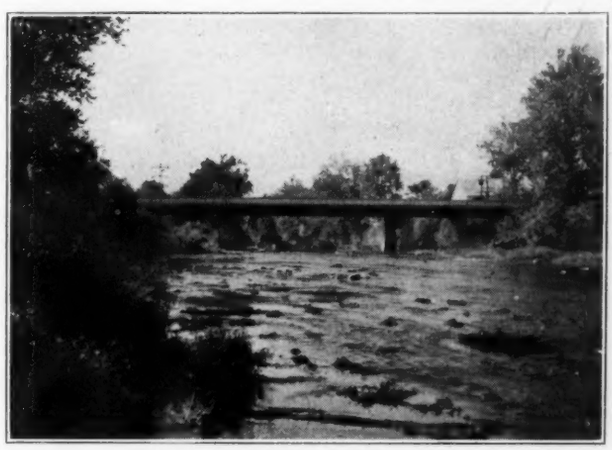
During these years the city has grown rapidly on both sides of the river until it has become an important center for industry, agriculture, and educational institutions.

With this growth some six mains have been laid across the river, connecting gridiron systems east and west and parallel to the river. Recently a new bridge was built across the river and an increasingly traveled highway improved, affording an opportunity to lay another main across the stream to connect two sixteen-inch dead ends, previously installed to points near each side of the river in accordance with a carefully laid plan, and in anticipation of reinforcement and improvement to the distribution system.

The Problem

The problem was to lay a sixteen-inch main from a point eighty feet south of the bridge to the bridge abutment, drop down eighteen feet to the ground level under the bridge, and then across the river under the north abutment, up eighteen feet, and north to the end of the present main forty-one feet north of the north abutment—a total distance of three hundred and eighty-four feet.

Part of the preliminary work of this job was the careful sounding of the river bottom from bank to bank along the proposed route of the new main, by which method it was found that the bottom of this stream was very uneven and consisting of various sizes of loose sandstone (river jacks), mud, sand, and silt. The depth of the water varied from zero to four feet. Under the above conditions, with water so shallow, it was believed that an expensive coffer-dam could be avoided; and yet, with water deep enough to prevent any type of pipe being laid without the use of divers, it was decided that the most economical and most practical method of performing the task would be with the use of sand bags and employing pipe with some type of mechanical joint. After considering the various mechanical joints for cast-iron pipes, it was decided to employ U. S. Flexible Joint Pipe, manufactured by the U. S. Pipe and Foundry Co., and designed to permit a sizeable deflection at each joint.



Looking Up-Stream to Bridge Beneath Which Main Was Laid

The Procedure

With the use of twelve hundred cement sacks and thirty-four yards of sand, one-half of the river was dammed, with clay packed against the up-stream side of the sand-bag dam. With the aid of several centrifugal ditch pumps we were then able to pump the water from the excavation in sufficient quantities to draw the water down to a depth of from twelve to eighteen inches. In this shallow water our workmen were able to make the proper excavation, producing a relatively smooth bottom and with a slight vertical curvature between the two banks.

Two eighteen-foot lengths of pipe were bolted together on supports and then lowered into the trench.

View of the North Half of the Crossing
This picture shows the sand bags, method of excavation, and the trestle on which the pipe was brought across the river. The pipe had already been laid across that half of the river beyond the sand bags.

Therefore, only every second joint had to be connected in the trench, in most instances underwater. Due to the fact that the type of pipe selected could be jointed under water, and due to its flexibility at each joint and ease of handling, it was selected for this job.

In this case we used Super De Lavaud Cast Iron Pipe, manufactured by a nearby foundry, in accordance with specifications based upon the Federal Specification No. WWP-421, for "Pipe-Water, Cast Iron (Bell and Spigot)." These pipes conformed in detail with the specification, in respect to dimensions, weights, and tolerances on all sizes and classes to which the Federal Specification applies, except that this pipe is cast with the special bell (see picture) as an integral part of each pipe.

With no inclement weather the work was accomplished with about twenty workmen in about two weeks, at a cost of slightly more than $3,800. It is believed that if a type of pipe had been used requiring a dry trench for joining, and necessitating water-tight coffer-dams, the cost of this job would have been increased by $500 or more.

A Coming Project

There is now in the process of construction a concrete and steel bridge of some 1,100 feet in length and crossing the Roanoke River at a point about one-half mile west of the location of the job that we have described above. The original specifications call for a 12-inch cast-iron standard bell and spigot pipe line to be laid along this bridge beneath a concrete sidewalk, and to rest on wooden pillow blocks on steel I-beams 10 feet apart, center to center. The specifications also call for several expansion joints to be installed in this line. But, we have enjoyed such apparent success with our initial use of mechanical-joint pipe that our intention is now to install on this new bridge the same type of jointed pipe as was used for the sub-aqueous crossing.

Between zero and 100 deg. F. there is an expansion of 0.72 inch per 100 feet in this cast iron pipe. Since the standard length of each section is 18 feet, there would be an expansion of 0.1296 inch per length over this temperature range. To take care of such expansion and contraction, after each joint is "belled up" if the spigot end is pulled away from the bottom of the bell 3/16 of one inch each joint will act as an expansion joint, and eliminate the need for and expense of special expansion joints in the line in question.

We are of the opinion that we are "pioneers" in our state in the use of this particular pipe, and if the recounting of our experiences results in any benefit to others in the waterworks field, we will feel happy if we have contributed something of interest, and possible value.

A Close-Up of the Joint
Foreman J. B. Ferguson looks down with a satisfied expression while a joint is made up for our camera man.

DESIGN AND OPERATION OF THE TOPEKA ACTIVATED SLUDGE PLANT

Part 2; Some Operating Experiences

By T. R. HASELTINE*

With the cooperation of W. E. Baldry, City Engineer, and P. E. Kaler, Plant Chemist, Topeka, Kansas

WHILE additions to the Topeka plant, already described in Part I of this article, published in the October issue of this magazine, were under construction, the City constructed sewers in the southwest district, and installed pumps to force that sewage to the East Side Plant. As a result, the average flow at the plant increased from 4.5 MGD to 5.6 MGD, or almost to the flow of 6 MGD, for which the activated sludge process was designed. However, the sewage from the new district is much weaker than that from the east side district proper, and the present equivalent tributary population is about 77,000 to 82,000, as compared to the equivalent population of about 100,000, for which the plant, employing the activated sludge process, was designed.

The Author

Sludge was transferred from the old digesters to the new primary digester early in December, 1936. The first primary sludge was introduced on January 4, 1937. A small flow of sewage was first turned into the aeration tanks on February 5th, but it was March 5th before the entire flow was receiving secondary treatment. Table III shows sewage flows and analyses for the first eleven months.

This is the second and concluding installment of an article of peculiar interest and more than ordinary value.

Unfortunately, the two parts could not be run in consecutive issues, as originally planned. So, the reader would do well to review or scan again the first part of Mr. Haseltine's article, which appears in our October issue. This, for the purpose of becoming familiar with the design of the Topeka plant and the aims of the designers, before reading of operating experiences, certain after-thoughts, and conclusions reached bg the designer-operator.

It has often been said that a designer with previous operating experience should turn out the most workable and flexible design, making for higher efficiencies and economies in operation. Messrs. Haskins and Haseltine, the Topeka plant designers, met all of the "specifications" of the operator-designer, and the results are revealed in this installment.

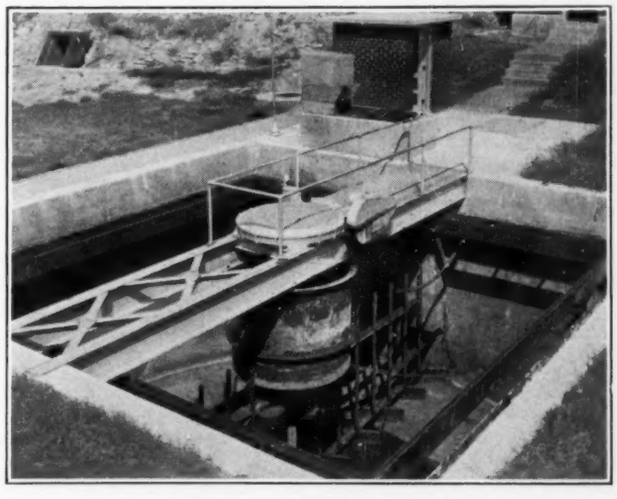
Although Mr. Haseltine's keen ability, as an experienced operator of difficult, activated sludge plants, served him and his firm well in the design of the plant, from his Topeka experience he has learned that performance cannot always be written in advance—particularly so in the case of activated sludge plants which are called upon to handle industrial wastes above a certain ratio to domestic sewage loadings which form the combination load.

What Mr. Haseltine's article even more pronouncedly confirms is—(1) That it is a wise city authority who retains an experienced operator to tune up and supervise new plant operation for the first six months, and preferably the full year; (2) That it is a fortunate designer who can influence his clients to continue his services in initial operation, with such an operator in charge of the plant.

Primary Treatment

Grit and Screenings

Screenings are collected in cans, hauled away and buried; no record of their volume or weight is available. Grit from the detritor is deposited in a sump, from which it is flushed through 6-inch pipe to the plant outfall. Settled sewage is used for flushing. The deposition of the grit is irregular, and hence the amount of sewage required for flushing varies. If not enough is used, the 6-inch line clogs and gives the operators considerable trouble. If too much sewage is used for flushing, the



Sludge Thickener at Topeka
(Note the smallness of this unit for a 6 M.G.D. plant. The "picket-fence" on the scraping mechanism enhances concentration of the flocculent sludge. For details see Part I of this article.)

*Supt. of Sewage Treatment, Butler and Grove City, Pa.; formerly with Charles A. Haskins, Consulting Engineer, Kansas City, Mo.

TABLE III

Month 1937—	Flow M.G.D.	Suspended Solids P. P. M. Raw Sew.	Suspended Solids P. P. M. Prim. Effl.	Suspended Solids P. P. M. Final Effl.	Suspended Solids % Removal Prim. Treat.	Suspended Solids % Removal Comp. Treat.	5 Day B. O. D. P. P. M. Raw Sew.	5 Day B. O. D. P. P. M. Prim. Effl.	5 Day B. O. D. P. P. M. Final Effl.	5 Day B. O. D. % Removal Prim. Treat.	5 Day B. O. D. % Removal Comp. Treat.
March	6.1	389	113	37	71	90	404	138	28	66	93
April	5.0	460	140	29	70	94	292	165	48	44	84
May	5.0	334	100	25	70	92	306	172	50	44	84
June	5.3	337	95	17	72	95	291	162	32	44	89
July	5.8	230	83	15	64	94	227	122	21	46	91
August	6.5	272	110	23	60	92	259	154	38	41	86
September	6.4	227	80	18	65	92	309	183	21	41	93
October	6.2	238	88	30	63	87	247	166	20	33	92
November	5.6	317	101	27	69	92	285	186	10	35	97
December	5.3	390	131	14	66	96	320	210	10	34	97
1938—											
January	4.8	345	120	22	65	94	392	279	12	29	97
Average	5.6	322	106	23	70	93	302	176	26	42	91

operators can forget about grit disposal and the river is the "goat." Therefore, constant supervision is required to prevent this latter practice. Some other means of grit disposal is probably desirable.

Grease and Scum

Topeka sewage normally contains a large amount of animal fats and grease, contributed by the meat packers. The pre-aeration tank is fairly effective in separating this grease from the sewage, but does not provide sufficient area (or time) for the grease scum to collect—hence a goodly portion of it collects as a scum on the primary clarifiers. The clarifier mechanisms were not originally equipped for skimming, and home-made skimmers have been installed, but they have not proved satisfactory and some of the grease passes on to the aerators.

It has been found that by reducing the amount of air used for pre-aeration, to the minimum necessary to prevent sludge deposition in that unit, more scum collects on it and less on the clarifiers.

In addition to the more or less regular inflow of animal grease, occasional heavy shots of oil and grease of mineral origin are received. Such discharges may last two or three days. It is not uncommon for the pre-aeration unit and the two primary clarifiers to be literally covered with a black blanket of this material. On such occasions considerable grease goes to the aerators and seriously upsets the activated sludge process. These inflows of mineral grease are most frequent during cold weather and their source is still unknown.

During 1937 all animal and vegetable grease was pumped to the primary digester; the mineral oil was skimmed into drums and hauled away, when possible. Sometimes it was necessary to waste it to the river, when no other disposal was practicable. Recently, an arrangement has been made with an individual to collect and remove all grease from the primary building. The same man collects grease from the surface of the wet wells of the various sewage pumping stations about town. His only compensation is income from the sale of the grease.

During August the surface of the primary clarifiers were covered with a dark scum and showed considerable gasification. The high sewage temperatures, 85 to 90 deg. F., and the septic condition of the incoming sewage, were believed to be the cause. However, similar temperatures prevailed during July without such troubles. The real cause is believed to be (a) the pumping of thickened activated sludge from the thickener to the inflowing sewage, instead of to the digesters direct; and, (b) the high solid content (2.4 to 5.5%) of the gas holder overflow which was also returned to the screened sewage. An excessive volume of primary sludge was pumped that month in an effort to overcome gasification in the clarifiers, and that increased the volume of gas holder overflow, thus further aggravating a bad condition.

The most serious condition prevailing at Topeka has been the gradual falling off in B.O.D. reduction through the primary end of the plant. This, in face of the fact that there has been no corresponding decrease in efficiency of suspended solids removal. Such a condition has thrown an increased burden on the secondary process, and has noticeably affected the condition of the activated sludge. After giving the problem much consideration, the only possible explanation occurring to the writer is the decreased air supply to the pre-aeration unit. Such decrease was made in an effort to reduce scum accumulations on the primary clarifiers.

Secondary Treatment

Table IV summarizes operating results from the activated sludge process. It has been the practice to never allow any accumulation of sludge in the final clarifiers, but no attempt has been made to reduce the rate of sludge withdrawal to the minimum compatible with that practice. During most of the time the rate of sludge withdrawal has been constant throughout the 24 hours, but recently it has been reduced slightly during low night flows. Tests, made at irregular intervals, indicate that this sludge ranges from 0.2 to 0.7% solids and has a volatile content of 70 to 76%. This procedure naturally

TABLE IV

Month	Sew. Flow M.G.D.	Lb. of B.O.D. to Aerators	Sludge Return M.G.D.	Aeration Period Hours Aera-tors	Aeration Period Hours Re-aeration	Suspended Solids in Aerators (p.p.m.)	Suspended Solids in Aerators lb. per lb. B.O.D.	Suspended Solids in Re-aeration (p.p.m.)	Sludge Index Aera-tors	Sludge Index Re-aeration	Air Used (Cu. Ft.) Per Gal.	Air Used (Cu. Ft.) Per Lb. of B.O.D.	D.O. Outlet Aerators (p.p.m.)
March	6.1	7,000	1.79	5.5	4.0	841	2.43	2,107	91	176	1.14	990	2.2
April	5.0	6,880	1.83	6.3	3.9	830	1.81	2,416	80	84	1.53	1,010	2.8
May	5.0	7,130	1.79	6.4	4.0	1,230	2.60	3,347	114	114	1.46	1,025	1.2
June	5.3	7,130	1.83	6 1	3.9	1,190	2.51	3,840	141	159	1.44	1,065	1.2
July	5.8	5,860	1.83	5.7	3.9	1,500	3.83	4,360	218	122	1.34	1,320	1.1
August	6.5	8,310	1.65	5.3	4.4	1,205	2.18	4,000	346	225	1.20	935	1.0
September	6.4	9,750	1.76	5.3	4.1	1,078	1.68	3,440	249	183	1.20	788	1.4
October	6 2	8,550	1.76	5.4	4.1	1,092	1.92	3,470	399	239	1.19	862	2.9
November	5.6	8,720	1.78	5.9	4.0	1,442	2.48	4,288	508	222	1.32	847	1.9
December	5.3	9,180	1.52	6.5	4.7	1,560	2 55	4,000	145	170	1.32	831	1.3
January	4.8	11,100	1.46	6.9	4.9	1,411	1.91	3,897	177	183	1.41	605	1.7

results in considerable hourly variation in the solids content of the aerators; all solids figures given in Table IV are based on samples collected six times weekly, at 9 A. M. Some authorities state that two pounds of suspended solids should be maintained in the aeration tanks for each pound of 5-day B.O.D. introduced by the sewage during the day. While this rule has not been applied intentionally, in the Topeka operation, it is interesting to observe how closely it has been followed. It is interesting to note that the use of nearly twice that much return sludge during July did not, seemingly, result in any better treatment.

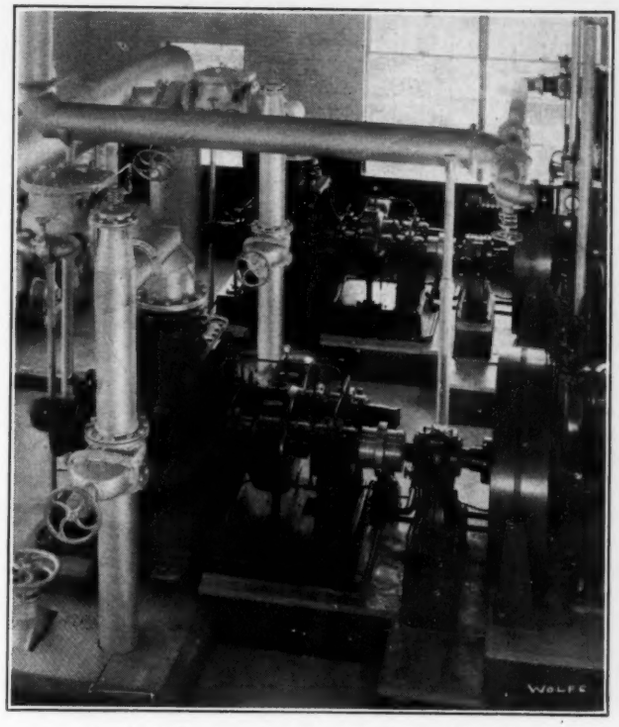
Under normal operation both gas engines are operated at 300 R.P.M. from 10 A. M. to 10 P. M., and but one engine (400 R.P.M.) the rest of the day, and on Sundays and holidays; this corresponds to approximately 6,200 and 4,350 cu. ft. of air per minute, respectively. Frequently, higher aeration rates are used and occasionally the air supply is reduced to conserve gas. Dissolved oxygen tests are made daily on samples collected at 3 P. M. from the outlets of the aeration tanks. About once a month samples are also collected from the third points and two-thirds points of the aerators and from the outlet of the sludge re-aeration tank. Mr. Kaler (Plant Chemist) considers that dissolved oxygen to the extent of 0.4 p.p.m. at the points, one-third way through the aerators, 0.6 p.p.m. at the two-thirds, and 1.0 at the outlets of aerators and re-aeration units, to be safe minimums. To maintain such conditions, the air supply is distributed roughly, as follows: 40% to inlet bays of the aeration tanks proper, 25% to their middle bays, 20% to their outlet bays, and 15% to the sludge re-aeration tank.

Concerning Aeration and Re-Aeration

Berg, after using from 680 to 1,720 cu. ft. of air per pound of B.O.D. in the primary effluent at San Antonio, states that 1,000 cu. ft. is about the minimum that will maintain a good sludge in proper condition. (Sew. Wks. Jour., vol. 9; p. 776.) The results of the first nine months at Topeka would indicate that a similar amount of air is required in this plant. However, the last two months would seem to show that appreciably less air is required when a longer sludge re-aeration period is maintained. Most of the newer American plants do not provide for sludge re-aeration, and, in general, I believe it has not been found of much value when treating straight domestic sewage. However, we considered it well worth while at Topeka in view of the high proportion of packing plant wastes in the sewage there. To date, Mr. Kaler has not had time to perform sufficient analytical work to show just what sludge re-aeration does accomplish; he expects to do such work and to try operation without sludge re-areation. In the meantime, it is interesting to note from Table IV that there was little difference between the sludge index in the aeration and re-aeration tanks, so long as the index was below 200, but that when a bulked condition prevailed, re-aeration appeared quite effective in reducing the sludge index. This tendency for sludge re-aeration to control bulking and the tendency for prolonged re-aeration to reduce the overall air requirements, noted above, would seem to justify its inclusion in plant design when the sewage is of a strength materially above that of domestic sewage.

Sludge Behavior

Although the sludge index has been abnormally high much of the time, indicating a bulky, low, gritty sludge, the design of the final clarifiers has been adequate to prevent any serious impairment of clarification and loss of sludge in the overflow. Table V, which shows the sludge index of the mixed liquor and the suspended solids in the final effluent, for every day on which the former exceeded 600 parts or the latter exceeded 50 parts, gives ample evidence of this fact.



Twin Roots-Connersville Blowers at Topeka

(Each delivers 4,000 cu. ft. of air against 8½ lbs. pressure; are direct connected to 3-cylinder Worthington Gas Engines. For details see Part I. of this article.)

TABLE V

Date	Sludge Index Mixed Liquor	Suspended Solids Final Effluent	Date	Sludge Index Mixed Liquor	Suspended Solids Final Effluent
Sept. 1...	840	21	Oct. 28...	517	146
Aug. 31...	747	20	Oct. 13...	491	106
Nov. 4...	700	30	Aug. 12...	310	100
Nov. 2...	685	24	May 9...	115	84
Nov. 3...	670	26	April 16...	91	64
Nov. 9...	664	14	April 25...	78	64
Aug. 17...	663	17	Nov. 11...	434	55
Nov. 10...	630	30	April 26...	70	50
Nov. 12...	629	32			
Nov. 27...	629	18			
Aug. 29...	626	10			

The occasional high solids content of the final effluent has been due, not so much to "bulked" sludge (high index) as to rising sludge. I refer to sludge that settles satisfactorily in the clarifiers, but rises again as large brown chunks before it can be withdrawn from the bottom. For example, late on the 14th of April, the raw sewage ran red with blood from one of the packing plants. For several days thereafter the incoming sewage was stronger than usual. At the onset of that condition the air supply was increased and a dissolved oxygen content of 2 to 3 p.p.m. was maintained at the outlets of the aeration tanks for the next two weeks. At the same time the mixed liquor contained 700 to 800 p.p.m. of suspended solids and had an index of about 80. Due to the increased air supply no serious bulking occurred; the index went up to 120 and back down to 80 during the two-week period. However, the surfaces of the final clarifiers covered with brown "chunks" of sludge, much

TABLE VI

Hours Sludge Stayed Down in Graduates	Ammonia Nitrogen —in Supernatant— High	Low	Avg.	Nitrite Nitrogen —in Supernatant— High	Low	Avg.	Number of Days Observed
Aeration Tank							
8 or more..	2.2	T	0.45	5.0	T	1.40	26
3 to 8.....	2.2	1.0	1.51	1.6	1.0	1.30	3
3 or less...	5.0	0.6	3.09	5.0	2.0	3.00	7
Sludge Re-aeration Tank							
8 or more.	1.5	T	0.30	3.0	T	0 80	19
3 to 8.....	3.0	0.2	1.26	2.0	0.2	1.03	7
3 or less...	5.0	2.5	3.74	3.0	0.2	2.05	9

of which passed over the weirs to raise the solids content of the effluent. In the laboratory the sludge would settle to from 5 to 12% volume (10 minutes in graduates), but would rise to the surface in from 15 to 90 minutes. There is published evidence to indicate that freed nitrogen gas causes the sludge to rise. While no nitrogen determinations were being made at the time of this trouble, it was assumed that the heavy discharge of packing house wastes had increased the nitrogen content of the sewage. If this sewage was to be satisfactorily treated, the liberation of some nitrogen gas could not be avoided. It was believed that, although the total amount of nitrogen so liberated was proportional to the nitrogen content of the sewage and so not subject to control, the amount of gas per unit weight of sludge could be reduced by increasing the weight of sludge in the mixed liquor and thus the buoyancy of the sludge would be reduced. The loss of sludge in the final effluent automatically retarded its building up in the aerators, but early in May the mixed liquor contained 1,200 to 1,500 p.p.m. of suspended solid and the clarifier surfaces were free of floating chunks. Since then Mr. Kaler has encountered similar troubles at times even when the suspended solid content of the mixed liquor had been dropped to 700 p.p.m., approximately.

At Sioux Falls, another activated sludge plant handling packing house wastes, they have encountered similar troubles and attribute it to a high nitrite content in the mixed liquor—(Sew. Wks. Jour., vol. 9; p. 959). Mr. Kaler has made ammonia and nitrite determinations in the Topeka aerators and re-aeration tanks during January and part of February. His findings, summarized in Table VI, do not indicate any more correlation between sludge rising with nitrites than with ammonia. However, they do seem to indicate that the higher the nitrogenous matter content, the shorter the time the sludge will stay down, thus checking the assumptions of last April. However, the absence of organic and nitrate nitrogen determinations leave even that conclusion in question.

Sludge Handling and Digestion

Sludge Thickener Performance

The sludge thickener was first put into operation on March 15th, thus I had only two weeks of first-hand experience with it. During that time I came to the conclusion that it would handle a maximum uniform flow of about 140 g.p.m. of final clarifier sludge, having total solids of 0.4 to 0.6%, and sludge index, 100 to 200. With a continuous sludge withdrawal of 14 g.p.m. from the thickener, it would produce a 3.0 to 4.0% solids sludge and a clear supernatant. Brief trials with chlorine to give a residual of 1 p.p.m. in the overflow did not appear to give a heavier sludge, but did produce a more turbid effluent. Since that time, Mr. Kaler has operated the thickener in several different ways. He feels he has learned several wrong methods, but has not yet hit upon the best one. He states that on an average for the year the thickener has produced a 2.3% solids sludge. He now feeds final clarifier sludge at the minimum uniform rate compatable with sufficient wasting and at times also the gas holder overflow (supernatant liquor) when it contains more than 0.2% solids. He pumps solids from the thickener whenever the sludge depth reaches 8 ft., and stops pumping when the sludge depth is reduced to 3 ft. One of the greatest troubles with the thickener has been an accumulation of heavy brown sludge (scum) on the surface. This is most troublesome during the periods when the sludge rises quickly in the final clarifiers. Chlorine seems to be ineffective in controlling it. Most of the Topeka experience has been on sludge from the final clarifiers, with only a few brief attempts to thicken mixed liquor from the aerators. At other plants, where thickeners are in use, the best results have been obtained when treating mixed liquor—(WATER WORKS & SEWERAGE, vol. 80; p. 179; and vol. 81, p. 107). On several occasions the thickener has been by-passed and final clarifier sludge wasted directly to the pre-aeration unit. Mr. Kaler has indicated these two methods of disposing of excess activated sludge to be about equal during cold weather, but that the thickener may have some advantages during warm weather. In this connection it should be noted that with present flows the Topeka primary clarifiers have about 2.8 hours of retention and a 600-gallon per sq. ft. per day overflow rate. Therefore, the wasting of excess activated sludge to the raw sewage might be more successful now than at design flows, or than it is

TABLE VII

MONTHLY TOTALS OF SLUDGE VOLUMES

Month	Waste Activated Sludge Cu. Ft.	Combined Primary and Thickener Sludge to Primary Digester— Cu. Ft.	Pct. Solids*	Pct. Volatile	Digested Sludge Drawn to Drying Beds Cu. Ft.	Pct. Solids	Pct. Volatile
March	429,333	141,466	6.3	65.3	2,700	12.9	49.0
April	636,000	144,720	6.0	65.6	9,000	13.3	42.4
May	235,600	163,688	3.9	65.0	11,700	14.4	44.7
June	280,000	218,936	3.1	63.5	36,900	8.6	46.5
July	212,040	141,959	3.6	66.3	44,400	7.8	47.7
August	512,533	213,900	3.4	66.1	42,900	8.0	46.7
September	494,664	122,788	4.4	69.5	10,200	7.6	44.2
October	461,533	121,355	4.4	69.8	8,400	9.0	45.0
November	260,000	92,400	7.1	71.1	12,600	9.2	46.2
December	372,000	116,998	7.0	69.0	27,300	8.2	48.5
January	340,000	134,773	4.7	...	36,300	...	48.3

*Computed from volume of sludge and overall solids reduction through plant.

TABLE VIII
PRIMARY DIGESTER SLUDGE

Month	10 Ft. Depth Pct. Solids	10 Ft. Depth Pct. Vol.	10 Ft. Depth pH	10 Ft. Depth Temp. (° F.)	20 Ft. Depth Pct. Solids	20 Ft. Depth Pct. Vol.	20 Ft. Depth pH	20 Ft. Depth Temp. (° F.)	30 Ft. Depth (Bottom) Pct. Solids	30 Ft. Depth (Bottom) Pct. Vol.	30 Ft. Depth (Bottom) pH	30 Ft. Depth (Bottom) Temp. (° F.)
January	0.4	38.0	6.8	91	9.3	46.0	6.9	89	9.4	42.8	6.8	84
February	1.6	46.5	7.0	85	3.4	45.7	7.0	86	5.1	44.0	6.9	84
March	4.2	46.6	7.0	89	3.9	45.7	7.0	88	4.5	46.2	7.1	89
April	4.0	53.3	7.1	89	3.9	52.3	7.2	89	4.1	52.4	7.1	88
May	3.4	50.8	7.2	93	3.7	50.2	7.2	93	4.9	51.1	7.2	93
June	3.5	53.7	7.0	90	3.6	52.6	7.0	90	3.4	52.2	7.0	90
July	2.9	54.2	7.1	94	3.5	53.1	7.1	94	3.1	53.3	7.1	94
August	3.2	53.8	7.0	94	3.3	52.6	7.0	94	3.5	52.6	7.0	94
September	3.0	53.8	7.1	93	3.3	52.4	7.1	94	3.6	51.1	7.1	93
October	3.6	54.1	7.1	93	3.5	52.4	7.2	93	4.1	52.0	7.1	91
November	2.8	53.3	7.2	92	2.6	51.9	7.1	91	3.2	50.8	7.2	91
December	1.4	48.0	7.0	89	2.9	51.6	7.0	86	4.9	52.2	7.0	87

at most other plants. Table VII gives some idea of what the thickener has accomplished to date at Topeka.

[It will be more interesting to observe what the thickener accomplished when handling *fresh* activated sludge taken from the aeration units, rather than at a stage of degradation *after* a period in the final tanks. Also, after the questionable practice of adding supernatant liquor is stopped.—Ed.]

Digestion

Table VII shows the volume of activated sludge wasted and the volume of combined primary and thickener sludge pumped to the primary digester each month. In addition, it gives the volume of sludge drawn onto drying beds and the analyses of sludges entering and leaving the digesters. The fresh sludge has a pH of 6.5 to 7.0, while that of the ripe sludge is 7.2 to 7.4.

Table VIII gives sludge analyses at various depths in the primary digester, and Table IX presents analyses of top and bottom sludge in the old (second stage) digesters. Table X contains data on the overflow liquor from the gas holder—in reality, supernatant liquor from the third stage of digestion.

An inspection of Tables VII to IX shows: (a) that most of the digestion took place in the primary digester; (b) that digestion was practically completed in the two (old) second stage tanks; and, (c) that there was no appreciable concentration of solids (sludge thickening) in the tertiary stage. Mr. Kaler states that the only reason for the occasional high solid content of the gas holder overflow was his failure to withdraw sludge from that (third stage) tank soon enough. He further states, that so long as that liquor contains only 0.2 per cent solids it may be returned to the preaeration tank without producing any ill effects on the activated sludge process. It is rather surprising that there was no solids concentration in this third stage, particularly so because there was so slight a reduction in organic matter there. The gas holder was kept heated throughout the year; perhaps the convection currents have been sufficient to prevent further solids concentration.

Concerning the primary digester, experience has shown that the Dorr Turbo mixers *alone* are not capable of maintaining a homogeneous sludge—see results of January and February 1937 in Table VIII. But, when gas production is high as it has been since then, the combined mechanical mixing and gas ebulition does produce a fairly uniform sludge throughout the lower two-thirds of the tank. Mr. Kaler reports a heavy scum in the top of the tank which he fears is steadily increasing in depth, particularly during the last few months. Such a scum formation would seem to indicate overloading. However, the high grease content of the sewage may be the responsible factor. Computations based upon the volumes of sludge entering the primary digester, given in Table VII, indicate that the average retention period in that stage has been 20.5 days and that only during June and August was the actual period appreciably less than the design period of twenty days. However, computations of seeding ratios indicate that the average daily weight of solids introduced into the primary digester has ranged from 4.7 to 8.9 per cent of the weight of digesting solids in the tank. The average for the last ten months of 1937 was 6.4 per cent, while the charges for November and December of that year were 7.8 and 8.9 per cent respectively—the highest for the year.

When the writer left Topeka he recommended that the daily charges should not exceed 4 to 5 per cent of the weight of digesting solids in the tank. It is his belief that the scum formation has resulted from too high an input volume ratio. While the high input ratio is directly chargeable to insufficient thickening of the fresh sludge it might be corrected by transferring sludge from

TABLE IX
SECONDARY DIGESTER SLUDGE

Month	West Tank Depth	West Tank % Sol.	West Tank % Vol.	West Tank pH	West Tank Temp. (°F.)	East Tank Depth	East Tank % Sol.	East Tank % Vol.	East Tank pH	East Tank Temp. (°F.)
Apr.	Top	4.2	44.4	7.1	88	Top	0.2	39.2	6.9	88
May	Top	4.6	44.8	7.2	91	Top	0.7	45.7	7.0	90
	Bot.	12.5	42.0							
June	Top	3.9	49.0	7.1	92	Top	2.4	49.8	7.0	91
	Bot.	9.7	46.2	7.2	92					
July	Top	0.5	48.6	7.1	94	Top	2.3	51.1	7.1	93
	Bot.	10.9	45.6	7.4	94	Bot.	9.2	49.7	7.3	92
Aug.	Top	3.7	52.8	7.2	94	Top	4.8	50.0	7.2	93
	Bot.	9.0	47.8	7.4	93	Bot.	9.6	49.4	7.4	93
Sept.	Top	Tank drained for re-				Top	2.1	47.6	7.1	94
	Bot.	pairs filled from East and Primary Digesters				Bot.	8.6	45.5	7.2	94
Oct.	Top	0.2	48.4	7.1	86	Top	1.2	48.9	7.1	93
	Bot.	8.3	48.9	7.2	87	Bot.	9.0	47.8	7.3	93
Nov.	Top	2.3	50.7	7.1	87	Top	0.7	51.3	7.2	91
	Bot.	9.0	51.5	7.0	86	Bot.	9.6	49.4	7.2	90
Dec.	Top	3.5	50.5	7.1	86	Top	6.1	49.6	7.2	90
	Bot.	10.5	47.0	7.2	86	Bot.	7.9	48.5	7.3	90

TABLE X
GAS HOLDER OVERFLOW LIQUOR*

Month	Per Cent Total Solids — High	Low	Average	No. of Detns.
March	0.2	0.17	0.18	2
April	0.2	0.17	0.18	5
May	0.2	0.18	0.19	4
June	5.5	0.18	1.48	8
July	0.2	0.20	0.20	4
August	5.2	0.19	2.82	4
September	2.8	0.80	2.10	3
October	0.2	0.16	0.17	4
November	0.2	0.16	0.17	4
December	0.7	0.18	0.32	5
January	2.3	0.18	0.74	4

*Supernatant digester liquor which has passed through the gas-holder.

the bottom of the secondary digesters back to the inlet of the primary digester (Piping is so arranged that that is possible). In addition to increasing the amount of seed sludge in the primary tank such a practice would result in crowding the fresh sludge through the primary digester in a shorter time thereby increasing the load on the secondary stage and, perhaps, even that on the tertiary stage. It should still prevent the addition of scum forming material directly to the old digesters whose mechanisms are incapable of coping with appreciable amounts of scum.

At any event it is obvious that under present operating routine the primary digester is overloaded, while the tertiary (3rd stage) digester is practically useless. Unless some change in operating routine is made which equalizes the load somewhat it is apparent that the present digesters are incapable of handling the sludge from the full population for which they were intended.

Sludge Drying

A total of 39 beds of sludge were drawn during the eleven months covered by this article. Drawing depths ranged from 9 to 20 inches; generally the latter. While this is admittedly too great a depth for efficient drying it has been practical to reduce the cost of cleaning. The old beds are cleaned by contract—$25.00 per bed, regardless of depth. The new beds are cleaned with a blade-grader. Much less time is required for cleaning with the grader, and the cost is only about $18.00. During dry, hot weather the drying efficiencies of the old and new beds are about the same, but during cold or wet weather, the old (underdrained) beds are superior.

Gas Engine Operation

The gas engines have operated very successfully and, in general, there has been more than sufficient sludge gas for their operation. Table XI, summarizing their operation, indicates that their efficiencies have been well maintained. When thickened activated sludge first entered the digester gas production fell off necessitating the use of considerable natural gas. During August trouble with the gas lines necessitated using natural gas again in appreciable amounts.

The engines are equipped with force feed lubricators. An average of 0.32 quarts of oil per engine operating hour has been added to these lubricators. Oil changes and additions to the crankcases totaled 306 gallons between March 14th and December 31st. Of that amount 80 gallons were consumed by one engine between September 7th and October 15th. That engine was dismantled and rings were found to be stopped with sludge and carbon. They were cleaned and the engine assembled with no new parts. Since that date it has required only 9 gallons of make-up oil in the crankcase. The only other trouble has been a burned exhaust valve which had to be replaced early in June at a materials cost of $15.00. The city has installed a "Hydroil" oil centrifuge, which has been in use since September first. It was a used piece of equipment which cost $475.00 installed. It is so piped that oil may be sent through it while the engines are in operation thus avoiding the necessity of heating the oil before treatment. Mr. Baldry (City Engr.) does not consider it an oil saver, and states that in his opinion the crankcase oil should be changed after 3,000 operating hours. Engine oil costs 55 ct. a gallon at Topeka.

Engine exhaust temperatures range between 800 and 880 deg. F. when operating at 300 r.p.m. and between 900 and 980 deg. F. when operating at 400 r.p.m. The engine cooling water supplies all the heat necessary for winter conditions and by the use of the cooling coils in the aeration tanks no trouble was encountered in cooling the engines during the summer.

TABLE XI
GAS ENGINE OPERATION (BOTH ENGINES)

Month	Air Output (M.C.F.D.)	Sludge Gas Used (C.F.D.)	Natural Gas Used (C.F.D.)	C. F. Air Per C. F. Gas	Running Hours Total	Minimum Speed R.P.M.
Mar.	6.929	61,830	2,448	107.8	534	380
Apr.	7.634	71,643	213	106.2	1,336	325
May	7.321	73,232	720	99.0	1,394	325
June	7.589	71,160	553	105.8	1,428	300
July	7.710	74,000	600	103.4	1,179	300
Aug.	7.771	70,813	3,787	104.2	1,177	300
Sept.	7.681	10,563	none	108.9	1,115	300
Oct.	7.360	68,100	none	108.1	1,091	300
Nov.	7.387	68,095	none	108.5	1,066	300
Dec.	6.915	63,768	none	108.4	1,020	300

Operating Costs

The regular operating crew consists of one Chemist in Charge and six operators—two to an 8 hour shift. During the summer an additional man is regularly employed to care for the grounds. Monthly cost figures are not available to the writer but the total expenditures for the year 1937 are at hand. Assuming an average flow of 5.7 m.g.d., these indicate an average operating cost of about $10.00 per million gallons. The corresponding figure for 1938 will probably be higher, because the activated sludge process will be used for twelve instead of ten months. The annual costs for 1937 are summarized as follows:

Salaries and Wages	$ 8,333.92
Electric Power	4,912.15
Water (purchased from city)	1,062.43
Natural Gas	183.37
Engine Oil	787.14
Sludge Removal	319.00
Service Trucks	788.94
Repairs	741.84
Improvements	829.41
General Insurance	993.08
Miscellaneous	974.31
	$20,925.59

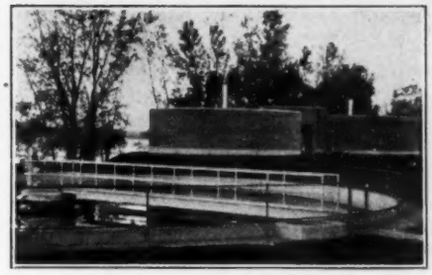
STANDARD SPECIFICATIONS FOR SEWERS

"A.P.W.A. Standard Specifications for Sewers, J1-38" has just been issued by the American Public Works Association. This new and much needed set of specifications cover sixty-nine pages in loose-leaf form, for inclusion in binders issued by the Association for other Standard Specifications for Public Works Construction.

These specifications cover every phase of sewer construction, including materials, excavation, monolithic and masonry construction, pipes and pipe sewers, piling, drainage, etc. They are the production of a committee of A.P.W.A., under chairmanship of Edwin R. Schofield of the Bureau of Survey & Engineering, Philadelphia.

Non-members of the Association may obtain copies of "A.P.W.A. Standard Specifications for Sewers" at $1.00 per copy. Address, American Public Works Association, 1313 East 60th St., Chicago.

CENTRAL STATES SEWAGE WORKS ASS'N AT MENASHA, WIS.



"On the Lake's Edge"
Is the plant of Neenah-Menasha

Features "Operators' Breakfast-Table Discussion" and Gadget Contest; Hears More About "Substrates," Tours India

THE 11th Annual Convention of the Central States Sewage Works Association was amongst the best. It was held October 13th and 14th in Menasha, Wisconsin, with an official registration of 149.

An innovation was the successful, and interest holding, "Operators' Breakfast-Table" Discussion. Likewise, featured was the Gadget Contest, with eleven gadgets on display, resulting in keen competition. As one feature of entertainment following the Annual Dinner, members

Officers

The Sec'y-Treas.—W. H. Wisely, Ill. Dept. of Health, Springfield, Ill. (Has put zip and go into the Association.)

The New President—Geo. J. Schroepfer, St. Paul, Minn. (Only recently made Chief of the Twin-Cities Sanitary Distr.)

The Retiring President—Prof. F. M. Dawson, Iowa City, Ia. (Left Wisconsin to become Dean of Engineering at Iowa.)

and guests were taken on "A Trip Through India" with Frank Bachman, who gave an enjoyable running account of the interesting things and customs of India. The talk was illustrated with slides and moving pictures obtained on a recent trip by Mr. Bachman.

The Neenah-Menasha Plant

On the first day's program the last order of business was a trip of inspection through the relatively new and modern Neenah-Menasha Sewage Treatment Plant, which gives primary treatment to the sewages of the two municipalites, plus a sizeable portion of paper mill wastes. The digested, or partially digested, sludge is dewatered on Conkey Vacuum Filters for destruction in a C.E.-Raymond Flash Dryer and Incinerator. To the sludge, "Ferrisul" solution is fed through exact proportioning "Ferr-O-Feeders," actuated by telemetering equipment which keeps the feeders in step with the sludge flows to the vacuum filters. The chief problem has been the quantity of clay, contributed in the paper mill wastes. It has produced an excellent filter cake, but has seriously reduced the heat value and raised the ash content.

Successful Gadgeteers

1st Prize:—To Don E. Bloodgood, Supt. of Sewage Treatment, Indianapolis; for his ingenious "Aeration Machine" employed to determine activated sludge activity and oxygen requirements of sewage-sludge mixtures. On this basis the activated sludge plant of Indianapolis is routinely operated, the required sewage-sludge ratio determined, and the volume of sewage to be sent to the plain aeration units providing bio-flocculation (no sludge return) and serving to take all loadings beyond those within safe limits of the activated sludge process. (The prize was $5.00, supplemented by a bronze plaque presented the Association by Dr. F. W. Mohlman for the purpose.)

2nd Prize:—Also to Mr. Bloodgood for his electric "Pump Timer," for automatic control of sludge pumping periods. (The prize was $3.00.)

3rd Prize:—To C. O. Baetz, Supt. of Sewerage, Appleton, Wis., for his "Valve Ball Remover," which consisted of a pair of tongs with curved jaws to fit and hold valve balls of sludge pumps, when lifting them from their seats. (The prize was $2.00.)

Prize-Winning Paper

For the best paper presented before the association in 1937, Dr. W. D. Hatfield, Supt. of Treatment Works, Decatur, Ill., was voted the annual award for his paper on **"The Viscosity and Pseudo Plastic Properties of Sewage Sludges."** (The award consists of the annual interest from a $500 bond held for the specific purpose.)

The Winner—The Plaque—The Donor

"Gadgeteer," Don Bloodgood, Supt. Treatment Works, Indianapolis.
(Took home first and second gadget money and the new plaque, here pictured on the wall of the Indianapolis plant.)
The Donor, Dr. F. W. Mohlman, Editor Sewage Works Journal. (Found himself also "awarded." To him a vote of appreciation for his excellent handling of the Journal.)

Officers Named

The following officers were unanimously elected:
President—George J. Schroepfer, St. Paul, Minn.
1st Vice-Pres.—B. A. Poole, Indianapolis, Ind.
2nd Vice-Pres—C. C. Larson, Springfield, Ill.
3rd Vice-Pres.—George Martin, Green Bay, Wis.
Sec'y-Treas.—W. H. Wisely, Springfield, Ill.
Representative on the Board of Control of the Sewage Works Federation—J. L. Ferebee, Milwaukee.

The State of the Association

In his annual report, Sec'y-Treas. W. H. Wisely had pleasing news for members, the gain in new members during his first year of his stewardship being 98, for a new high of 422 members. There also was a healthy net income of $254, above expenditures, boosting net assets to $1,083. Mr. Wisely pointed out that membership had practically doubled within two years' time and New York State's lead was rapidly being cut down by the Central States Association.

Technical Sessions

Following the welcome delivered by W. H. Clifford, President of the Neenah-Menasha Sewerage Commission, the opening paper on **"Sludge Drying and Incineration,"** scheduled to be presented by D. C. Reybold, of The Dorr Company, was read by C. W. Gordon, of Combustion Engineering Co. The paper described the two-stage C.E.-Raymond System of flash drying of sludge cake, followed by pulverizing and disposal of the dry material as fertilizer or as furnace fuel, at will. He reported 7 installations now in service or under construction. The largest described was the eight unit installation at Chicago's Southwest Plant, with a capacity of 160,000 pounds of water evaporated per hour, where the pulverant sludge was mixed with powdered coal for its fuel value, or as much as desired taken out for fertilizer.

In reply to questions, Mr. Gordon stated that sludge cake moisture content between 60 and 70 per cent made little or no difference, because recirculated dry sludge was added to adjust moisture of mixture entering the cage-mill (flash dryer) to between 40 and 50 per cent moisture. This operation might require as much as 3 parts of dry sludge to 1 of wet sludge cake. Then the mixture leaving the dryer should contain 5 to 8 per cent water for most satisfactory combustion.

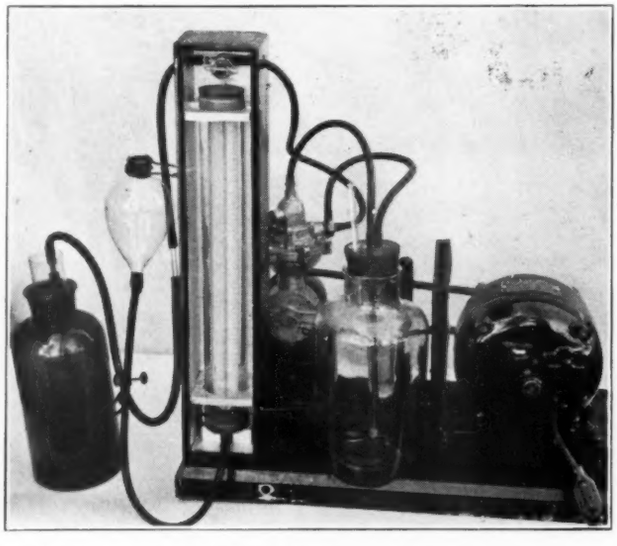
Activated Sludge Papers

"Activated Sludge Oxidation—The Effect of Sludge Concentration and Temperature on Oxygen Utilization," by CLAIR N. SAWYER and M. STARR NICHOLS, University of Wisconsin, Madison, Wis.

This research paper, presented by Mr. Sawyer, went into the effects of sludge concentration and temperatures of mixed liquor on the rates of oxygen utilization in the activated sludge process. These studies revealed two distinctive stages in the matter of oxygen take-up rate. In the first stage, following sludge addition, the prevailing rate was 3 to 4 times that of the second stage. As to be expected, the rate (especially in the initial stages) proved to be almost in direct relation to sludge concentration and temperatures between 10 and 25 degrees Centigrade. However, during the 3rd hour of aeration the rate of oxygen utilization proved higher with low sludge concentrations than otherwise, something to be considered in tapered aeration. An interesting observation was the fact that storage of sludge for 24 hours had not appeared to affect the sludge activity. Mr. Sawyer also described the "Oxy-Utilometer" which had been developed for making exact measurements of oxygen utilization in laboratory scale studies. The results reported from the Madison studies, involving two sludges, gives some evidence of why sludge bulking is prevalently a warm weather problem and why sludge return control and tapered aeration seem to be of paramount importance in the activated sludge process.

"The Measurement of Biological Oxidation," by DON E. BLOODGOOD, Supt., Sewage Treatment Works, Indianapolis.

Mr. Bloodgood, aided by lantern slides, described the Indianapolis "Aeration Machine" (prize winning gadget) which has been successfully used for several years in the control of sludge return and process loading at Indianapolis. The manipulation of the machine was described in the routine daily testing for immediate oxygen demand of the sludge (15 minutes required) and thereafter the "Sludge Activity Factor," requiring 90 minutes for both tests. Mr. Bloodgood felt that it was time well spent in insuring satisfactory plant performance, maximum permissible loadings and operating economies. It was possible, he said, to eliminate the



The Indianapolis "Actometer"

(More than a gadget, costs less than $25.00 to build if you know how, deserves a $100.00 name. Bloodgood called it an "Aerating Machine"; we add $75.00 and dub Indianapolis' sludge activity-meter the "Actometer"—but, after all, it's Bloodgood's machine.)

first part and cut the test time to 45 minutes. The machine (here pictured) was constructed in the Indianapolis laboratories from parts purchased at a total cost of $24.38.

[These parts are listed, with specifications, in the paper which is to appear in an early issue of Sewage Works Journal. The test procedure is also detailed.—Ed.]

Some case history was then cited by "Gadgeteer" Bloodgood, to show the value of the Indianapolis "Aeration Machine," for revealing trends in the process and making possible their correction before real troubles appeared. Interestingly, over-aeration at Indianapolis had been the source of almost as many troubles as under-aeration.

Interesting were the Indianapolis studies of the effects of certain industrial wastes on sludge activity and oxygen utilization rates. Pasteurized skimmed milk produced no harmful effects when added in amounts to raise the B.O.D. of the sewage to 566 p.p.m. Tomato wastes at first produced a lowering of oxidation rate, but larger additions (230 p.p.m. B.O.D.) disproved any harmful effect to the sludge activity. Corn wastes produced results similar to tomato wastes. Investigation proved that all three wastes were quickly absorbed by the sludge solids, thus reducing the rate of oxygen utilization but not the sludge activity. Mr. Bloodgood, in consequence, suggested the "Aeration Machine" for determining the reasonable limits of plant loadings in the form of industrial wastes.

A further interesting study, involving activity and characteristics of trickling filter film (sludge), proved such qualities to be essentially those of some activated sludges. Mr. Bloodgood suggested, in consequence, that consideration might well be given to design and closer regulation of sprinkling filter operation, for securing maximum results and greater economies in area requirements, et cetera.

[From all of this, it is apparent that Mr. Bloodgood's most useful tool in the diagnosis of activated sludge and trickling filter performances deserves a very high rating amongst "gadgets."—Ed.]

"Total Purification, Oxidation, Absorption and Synthesis of Nutrient Substrates of Activated Sludge," by C. C. RUCHOFT, C. T. BUTTERFIELD, P. O. MCNAMEE and ELSIE WATTIE, U. S. Public Health Service, Cincinnati, Ohio.

Presented by the senior author, this paper is as profound as is its caption. It is the fourth of a series, revealing findings and basic principles of the activated sludge process. This particular paper is an amplified presentation of findings from a study of the clarification and reactivation phenomena of the activated sludge process. The first (clarification) stage usually reaches equilibrium within 30 to 40 minutes; the second (reactivation) stage constitutes the long and costly period of restoration of the powers of clarification of sludges. In brief, the first is predominantly bio-flocculation (plus adsorption and absorption); the second is essentially bio-oxidation and activation. The most valuable part of the paper is that which reveals to what extent the first and second stages are inter-dependent and overlap.

While this paper cannot be effectively presented in digest form, some of the more easily comprehended revelations were the following: (1) During the first 30 minutes of aeration of mixed liquors, of the total purification accomplished 2.5 to 30 per cent was performed by bio-oxidation. (2) After five hours of aeration oxidation accounted for 30 to 60 per cent of the total. (3) The phenomena of absorption and synthesis reaches a maximum between 1 and 1.5 hours of aeration, accounting for 50 to 70 per cent of the total purification between 30 minutes and 3 hours. (4) Overloading with B.O.D. in the substrate caused 70 per cent of the total purification to be accomplished by adsorption and only 30 per cent through oxidation—i.e., within practical time limits of aeration in plant practice.

Frank Eachman The Dorr Co. (Through India he took members)

C. C. Larson, Supt. of Treatment, Springfield, Ill. (Vice-President of C. S. S. W. A.)

[Mr. Ruchoft's "substrate" is the liquid portion of sewage-sludge mixtures.—Ed.]

The authors state that their studies reveal the need for careful attention to air adjustments and proportioning of sludge to substrate in practical operation. They question the value of sludge re-aeration, in many instances, and point to the hazards of too long aeration periods in dealing with weak sewages. Air in excess of that required to maintain sludge in thorough suspension, plus only a small residual of dissolved oxygen in the substrate, seems unnecessary and ordinarily wasteful practice. Most assuredly the importance of bio-oxidation, throughout the process, was demonstrated in the studies and the ratio between work done by adsorption and synthesis and that performed by oxidation seems dependent upon the state of division of oxidative materials in the substrate and the quality (activity) of the sludge.

[Here is the fourth of an enlightening and valuable series of papers which deal with fundamental principles of the activated sludge process. Like the earlier papers of the series, it deserves study by operators and designers. The Public Health Service studies emphasize the need for plant design to afford maximum operating flexibility, if operating economy and efficiency is to be assured.—Ed.]

Discussion

In the discussion of the three above papers, Dr. Mohlman brought out that the apparent desirability of carrying high sludge concentrations in the mixed liquor and shorter aeration periods had practical limitations in ac-

C. O. Baetz, Supt. of Sewerage, Appleton, Wisc. (Successful "gadgeteer," with a worthy gadget.)

George Martin, Supt. of Sewerage, Green Bay, Wisc. (New Vice-President of the Association.)

L. S. Kraus, Chief Chemist, San. Distr., Peoria, Ill. (Revealed operating experiences with sludge concentration by centrifuge.)

(1) R. A. North, Pres., Green Bay Foundry and Machine Wks.; (2) A. L. Gail, Supt., North Shore San. District, Highland Park, Ill.; (3) "Bob" Steindorf, Engr., Chain Belt Co., Milwaukee; (4) John Dietz, Supt. of Sewerage, Mundelein, Ill.; (5) T. C. Tupper, Monsanto Chemical Co., St. Louis; (6) A. W. West, State Dept. Health, Chippewa Falls, Wisc.; (7) R. B. Everson, Pres. Everson Chlorinator Co., Chicago; (8) Jerry Donohue, Cons. Engr., Sheboygan, Wisc.

tual plant operation. Concerning sludge re-aeration, the British favored it for their strong sewages, the return sludge containing but 0.5 per cent solids. However, in the mixed liquor low solids content was favored—800 to 1000 p.p.m. only—in England.

C. C. LARSEN, Supt. of Treatment Works, Springfield, Ill., spoke concerning the relationship between permissible sludge concentrations in the aerators and temperature. Because of increased sludge activity and rate of oxygen utilization, they at Springfield had found it necessary to carry lower solids concentrations in summer than in winter, purely on the basis of observation.

In connection with the Indianapolis method of sludge control, it was emphasized by MR. BLOODGOOD that it was folly to attempt to treat more sewage than the process would stand, and something else should be done with the overload. Someone remarked that he would call doing that "something else" with the overload just a little "cheating."

[At Indianapolis that "something else" amounts to diverting the sewage overload to plain aeration units, held for the purpose. Therein some purification results from bio-flocculation and, we suspect, some slight bio-oxidation is realized in the final stages. Another asset at Mr. Bloodgood's plant are a few well designed sludge lagoons in which to "unload" his worries.—Ed.]

DR. MOHLMAN suggested some further expression from operators present. His question was "Why, in practical operation, does one operator claim that 3,500 p.p.m. of solids in the aeration units gives optimum performance, while another finds 1,200 p.p.m. best?" For example, such differences, said Dr. Mohlman, were to be found at two expertly operated plants—Milwaukee, Wis., and Springfield, Ill.

In reply, C. C. LARSON (Springfield) stated that on practical grounds he considered carrying the permissible *minimum* of solids to be the safest and most economical operating practice. At Springfield, 1,000 p.p.m. was about the low limit. Amongst the dangers of maintaining solids in excess of actual requirements was the difficulty of getting them down, by wasting, when found necessary to relieve the total oxygen demand of sludge and Ruchhoft's "substrate." Mr. Larson intimated that by playing safe on solids (sludge) load the by-pass valve might be found a less essential unit in activated sludge plants.

[Disappointingly, none rose in defense of the practice of maintaining maximum permissible solids in the aerators and what might have been a highly enlightening exchange of experiences and ideas proved a "dud." Here is a question of merit for discussion at other meetings.—Ed.]

"Concentration of Activated Sludge With a Continuous Feed Centrifuge," by L. S. KRAUS, Chemist, and J. R. LONGLEY, Chief Engr., Sanitary District, Peoria, Ill.

This paper, presented by Mr. Kraus, revealed experiences and presented cost data in connection with tests involving an especially designed DeLaval Centrifuge for the purpose of concentrating activated sludge going to digestion tanks. Mr. Kraus pointed out plant operating deficiencies, which came as the result of delivery of waste activated sludge to heated digesters. Settling out of the sludge in primary tanks had been a help, but even so, the resultant reduction of 50 per cent of the liquid content of waste sludge was not sufficient on several

L. F. Warrick, State San. Engr., Madison, Wisc.
(America's Handsomest State Sanitary Engineer.)
Gladys Swope, Chemist, N. Shore San. Distr., Waukegan, Ill.
(Believed to be America's only Sewage Works "Chemistress.")
B. A. Poole, State San Engr., Indianapolis, Ind.
(First Vice-President of the Association.)

very practical grounds. Especially was this true where gas utilization for power development is involved. Aiming at production of a thickened sludge of 5 per cent solids content, from one of 1 per cent solids, the centrifugal method had been given a 6 months' trial. The DeLaval Centrifuge and its functioning, producing 6,000 times the force of gravity, was described by Mr. Kraus, who listed its good points and weaknesses. Of the latter the only serious matter had been the necessity of careful preliminary screening through a 30-mesh wire Robinson Vibrating Screen, to prevent possible cloggage of valve ports in the machine and vibrations resulting at such high speeds.

In revealing experiences with the method as employed on a semi-plant scale for a 6-month period, Mr. Kraus stated that the centrifuge handled 1,824 gals. of 1 per cent solids sludge per hour, representing 3,000 lbs. of solids. A concentration to 5 per cent solids had been aimed at as the economical point of power consumption and equipment costs, the average realized being 4.77 per cent solids. Between 3.5 and 6.5 per cent of the solids had returned to the aeration units by way of the centrifuge effluent; 3.2 per cent had been taken out by the vibrating 30-mesh screen and by-passed around the centrifuge. The solids in the machine effluent were of the lightest gravity, but had given no difficulties in their return to the aerators. In the concentrate, 76 per cent of the solids had been accounted for. The overall volume reduction of the concentrated sludge had averaged

80 per cent, which would constitute a worthy benefit in digester operation. A weakness had been the blinding of the fine screen, necessitating (for absolute safety) 4 shut-downs and cleanings per day, representing 5 hours of shut-down.

Concerning costs, the following estimates had been set up for the Peoria plant, requiring 5 centrifuges at a gross cost of $45,000 installed.

Fixed Charges	$3,970
Power at 3½ cts. K.W.H.	1,960

Other charges brought the total annual cost up to $12,700 per year—equivalent to a cost of $5.80 per ton of dry solids handled.

What Not-to-Do with Digesters

"Digestion Experiences at Aurora, Ill.," by WALTER A. SPERRY, Supt., Sanitary District, Aurora, Ill.

Mr. Sperry, in his usual modest and convincing manner, recited experiences with digester operation at Aurora, which revealed the considerable value of concentration of secondary tank sludge from trickling filters, prior to pumping to digesters. He explained how for $1,400 he had been able to convert Aurora's single type digesters to secure multi-stage digestion. The results were disappointing. Then, a study of plant records revealed the cause. Pumping of secondary tank (trickling filter) sludge direct to the 1st stage digester was responsible for a too rapid displacement of solids, plus digester cooling and all the grief that goes with both. Studying the pumping schedule, and, considering the average solids content of the secondary sludge (3.7 per cent), revealed a 236 per cent total sludge volume increase and resultant (theoretical) digestion period of only 36 days. With corrected pumping program, the average solids content was boosted to 5.2 per cent, resulting in a 49-day digestion period. With further improvements, an 80-day period resulted and, finally, the practice of pumping secondary sludge to the 2nd stage digester had been adopted, with still further improvement. Now the sludge in the digester averaged 10.2 per cent solids, against 4.9 per cent prior to the improved pumping program. Since only the availability of good records had made the correct diagnosis and correction possible, Mr. Sperry said that the value of dependable records had been once more proven.

Dr. W. D. Hatfield, Supt., Treatment Works, Decatur, Ill. (To him the award for the best 1937 paper.)
Prof. H. E. Babbit, Univ. of Ill., Urbana, Ill.
Walter E. Sperry, Supt. Treatment Works, Aurora, Ill. (Believes in "good housekeeping," good records and sludge concentration.)

Discussion

Both DR. MOHLMAN and L. H. ENSLOW commented on the value of sludge concentration prior to digestion as an economy measure, as well as one providing operating benefits. Each of the two papers just presented had indicated the attention being given to this important operating phase and experience at Los Angeles, Phoenix, Arizona, Durham, N. C., Topeka, Kan., and elsewhere had set a trend. Mr. Enslow stated that the new plant at Baltimore, Md., was adopting the Los Angeles method, while the Columbus, Ohio, plant had choosen the centrifugal method reported on by Mr. Kraus.

"Chemical Treatment at Waukegan, Ill., by GLADYS SWOPE, Chemist, North Shore Sanitary Districts, Waukegan, Ill.

Miss Swope, the only woman, so far as known, who occupies the position of Chemist in Charge of a sewage treatment plant (and does so admirably), operates the Waukegan Chemical Treatment Plant, in which rapid air mix is followed by mechanical flocculators, providing 35 minute flocculating period. Sedimentation and digestion take place in Imhoff tanks providing a 2 hour detention. Pre and post chlorination is employed as required.

Miss Swope presented a summary of operating data for 1937 and pointed out that chemicals had been applied 15 hours (7 A. M. to 10 P. M.), because of the non-necessity of treating the night and early morning sewage, low in volume and subject to little improvement by chemical treatment. Average chemical dosage had been 80 lbs. of ferric chloride and 277 lbs. of lime per million in 1937. Since, then, studies had revealed that the use of lime with the iron salt had not improved results appreciably. Ferric chloride alone appeared to reduce the B.O.D. value more, although suspended solids reduction had been less.

[There have been other observations of like nature, indicative that iron salts in some manner combine with putrescible matters to render them less amenable to utilization as bacterial food.—ED.]

During the summer of 1938, lime had been omitted and the average dosage of ferric chloride had been 1 gr./gal. in July and Sept., 2 gr./gal. in August. Such treatment had produced a 70 per cent overall reduction of the five-day oxygen demand. Miss Swope then reported the results of recent studies with the Baylis silicate method, as an aid to coagulation—the optimum treat-

(1) M. D. Sanders, Chemist, Swift & Co., Chicago; (2) R. W. Frazier, Supt. of Sewerage, Oshkosh, Wisc.; (3) John C. Mackin, Supt. of Sewerage, Madison, Wisc.; (4) "Bob" Cowing, Monsanto Chemical Co., Chicago; (5) H. H. Jones, Supt. Treatment Works, Michigan City, Ind.; (6) W. G. Kirchoffer, Cons. Engr., Madison, Wisc.; (7) R. C. Bennett, Trustee, San. Distr., Springfield, Ill.; (8) J. C. McIntyre, Supt. Treatment Works, Cedar Rapids, Iowa; (9) R. E. Bragstad, City Engr., Sioux Falls, S. D.

(1) Larry Lingnor, WATER WORKS & SEWERAGE (Chicago), and C. S. Wilcan, Link Belt Co. (Chicago); (2) R. T. Cowing, Monsanto Chem. Co. (Chicago) and Phil Schriner, Supt. of Treatment, Kankakee, Ill.; (3) C. K. Cornilsen (Chemist) and Walter Ashdown, Supt. of Sewerage, Chicago Heights, Ill.; (4) W. E. Ross, Supt. of Treatment Works, Richmond, Ind., and Tom Burrin, Supt. of Water & Sewerage, Lebanon, Ind.; (5) O. T. Birkness, W. & T. Co., Chicago, and E. J. Beatty, Prin. Asst. Engr., State Dept. Health, Madison, Wisc.

ment being 1.5 gr./gal. of aluminum sulphate and 0.2 gr./gal. of silica, resulting in 76 per cent reduction in B.O.D. value and 84 per cent suspended solids removal.

Dr. Mohlman, in commenting on Miss Swope's work, stated that silicate also had a marked effect in coagulating Chicago sewage, reducing overall costs. At present a combination of ferrous sulphate and silicate was under study, the results being very gratifying to date.

K. L. MICK, Chemist, Minneapolis-St. Paul Treatment Works, had found alum and silicate improved flocculation so far as appearance went, but produced little if any improvement in overall purification. He also had found lime of slight benefit on Twin-Cities' sewage coagulated with chlorinated copperas.

J. CORYDON, President, Proportioneers, Inc., spoke of the economy and efficiency of automatic solution feed in chemical treatment, such proportioning feeders (chemical pumps) being readily changed from one chemical to another at will.

The Neenah-Menasha Plant

Just prior to the inspection of the Neenah-Menasha Treatment Plant, it was described by J. M. HOLDERBY, Plant Superintendent, who also briefly reviewed operating experiences and results.

The plant provides treatment for the domestic sewage and paper mill wastes of the adjoining cities of Neenah and Menasha, Wis. Although the plant is designed and equipped for chemical precipitation, to date nothing beyond plain sedimentation has been necessary. At times the combined sewage consists of 6 volumes of paper wastes to 1 sewage, flow variations being 1 to 11 M.G.D. The primary sludge, containing 8 per cent solids, is conditioned with 1.3 per cent ferric chloride and 6 per cent lime. Dewatered on Conkey Vacuum Filters, the sludge cake averaging 66 per cent moisture content, is dried and burned in a Combustion Engineers' (Raymond) system. Conditioner control consists of titration of the filtrate and seeking to maintain a phenolptholin alkalinity of 300 p.p.m. Filter yields are averaging 8 lbs. of dry solids per sq. ft., with one filter doing the job. Medium weight cotton flannel had proved the most satisfactory and economical filter covering, the cloth life being 100 to 300 hours. Because of the clay and whiting (calcium carbonate) coming down in the mill wastes, the dried sludge averaged only about 40 per cent combustible matter, and had the low B.T.U. value of roughly 3,500. Through gradual improvements, fuel oil consumption had been lowered from 36.4 to 10.8 gals. per ton of dry solids. Due to break down of the carbonate (whiting), the ash contained 30 per cent calcium oxide.

J. M. Holderby, Supt. Treatment Works, Neenah, Wisc. (Intended to incinerate sludge, found he had a lime kiln too.)

O. M. Leonard, Engr. of Sewerage Design, Fort Wayne, Ind. (A past-president with a sizeable P. W. A. sewerage project on his books.)

Clair N. Sawyer, Univ. of Wisconsin, Madison, Wisc. (Developed an "Oxy-Utilometer" to study sludge activity.)

Operators' Breakfast-Table Discussion

Vice-Pres., C. C. LARSON—Leader

Topic No. 1—"Solids Accounting"

L. W. HUNT, Chemist, Galesburg (Ill.) Treatment Plant, presented figures for his plant, which revealed that the recorded sludge volume to digesters and laboratory analysis gave the calculated solids removal figure of 67,638, whereas from the sampling of crude sewage and effluent, the higher removal of 82,498 lbs. had been calculated. Which was the most likely correct figure, was the question raised.

GEORGE MARTIN, Supt., Green Bay (Wis.) Treatment Plant, reported a like experience, but his figures had averaged roughly but a 10 per cent difference with the two methods. However, on one day the difference was about 200 per cent—namely, 24,000 and 8,000 lbs. of solids. His sludge measuring method was the tipping trough scheme devised by W. A. Sperry at Aurora, Ill.

WALTER A. SPERRY, Supt., Aurora (Ill.) Sanitary District, stated that here seemed to be no "rhyme or reason" between measured sludge and solids removal, when calculated from crude sewage and effluent analysis, which at Auora has varied, from actual sludge records, over the range of minus 10 to plus 50 per cent. A difference averaging 5 per cent had been observed on crude solids as against 3 per cent for secondary sludge from trickling filters—both being long time averages. He suspected that the method of collecting samples of crude sewage was the responsible factor. Mr. Sperry was requested to sketch and describe his calibrated tipping sludge-trough and its automatic sampling feature. This he did.

W. D. HATFIELD, Supt., Decatur (Ill.) Treatment Works, added that in samples of sewage held over for a day the suspended solids would frequently increase due to a natural clotting of psuedo-colloidal matter. In other instances a peptization of the solids would yield lower figures.

J. I. SMITH, Plant Chemist, Chicago Sanitary District, felt that solids accounting from sewage analyses

(1) Miss "Glad-eyes" Swope, Waukegan's Chemist, and a fellow named J. Corydon, from Providence, R. I. (We bet he's trying to sell a "Silic-O-Feeder."); (2) Math. Fisher, Mgr. Water and Sewerage, West Bend, Minn., and T. F. Corpronan, Merrick Scale Mfg. Co., Passaic, N. J.; (3) R. B. Ehlers, Sales Engr., and W. W. Allen, Development Dept., Dow Chemical Co., came to learn more about Ferric Chloride in Sewage Treatment—also to sell a little, perhaps; (4) John R. Palmer, Chemist, Chicago San. Distr., first to produce and use "Chlorinated Copperas," and C. O. Bruden of W. & T. Co. (Madison, Wisc.) who is glad that he did so. (5) Leland Bradnee, Chemist, and B. T. Yeager, Commissioner of Sewerage, Sioux Falls, S. D.

was all wrong. He revealed an interesting comparison of solids secured by hand sampling (hourly) and that from an automatic sampler operating every 3 minutes, in which the latter yielded higher results. He described the method of running suspended solids determination (now employed at Chicago plants) in which a sizeable sample is filtered through tared perforated aluminum dishes containing a filter paper. The method was being used with satisfaction and accuracy sufficient for sludge solids determinations.

[To summarize: From all that was heard in this discussion, and also prevoius discussions, it seems apparent that solids removals calculated from sewage and effluent analyses may be so far from actual accomplishments that no dependability can be placed on such accounting, either as to revealing efficiencies of settling processes or in solids accounting. The use of large sludge samples for solids determinations, careful measurement of sludge volumes and truly representative sampling, should become approved standard practice.—Ed.]

Topic No. 2—"The B.O.D. Determination"

Discussion of this topic, which always constitutes material for much debating and speculation, revealed the many opportunities for error in such a test which involves biological balance and bacterial behavior.

DR. M. STARR NICHOLS (Univ. of Wisconsin) led off by saying that as little as 0.0036 p.p.m. of copper in the dilution water (such as would be picked up in passing through a brass or copper cock) had affected the test. Determination of B.O.D. value of industrial wastes and sewages separately, and use of the figures in calculating expected resultant B.O.D. value of mixtures of each, had never checked results secured on the same mixture when prepared and tested. Therefore, resultant B.O.D. of mixtures could not be predicted by calculations based on tests on each component.

DR. W. D. HATFIELD (Decatur, Ill.) reported apparent dropping off of B.O.D. in samples held over at various temperatures. During the first 5 to 6 hours the following drops had been noted:

at 4° C..... 15% drop
at 20° C..... 20% drop
at 37° C..... 35% drop

Not only was such true for settled sewage, but also for nitrified effluents. In the case of industrial wastes of 600 p.p.m. B.O.D. no such drop had been observed.

L. S. KRAUS (Peoria, Ill.) reported that as much as 50 per cent differences in B.O.D. values had been observed when varying the dilution, now checks on beer-slop being the most pronounced. In the case of paper mill wastes differences of 20 per cent had been noted.

Although at Minneapolis, Mr. Mick reported that he had been able to secure remarkably close checks on two different dilutions, Sioux Falls, S. D., reported that checks had only been possible by pasturization of the samples and re-seeding of the dilutions.

E. J. BEATTY (Wis. Dept. of Health) reported that a plant laboratory and the Health Department Laboratory could not check each other closer than 200 per cent,

H. M. Heisig, Chief Chemist, Sewerage Commission, Milwaukee, Wisc.
(Members wanted to know why he carries 3,500 parts solids; he wouldn't tell—possibly "under advice of counsel.")
E. E. Smith, Supt. Sanitary Distr., Elgin, Ill.
(A past-president and top-notch operator.)
C. C. Ruchhoft, Chief Chemist, U. S. Health Service, Cincinnati, Ohio
(Introduced us to "Substrates" in 1936; is getting the "low-down" on activated sludge behavior.)

namely, 20 and 60 p.p.m. on effluent samples. Such a state of affairs was very disconcerting—in fact, disturbing.

The convention closed with a luncheon at which gadget prizes and awards were delivered. Appropriate resolutions adopted included an expression of appreciation of the splendid work of Dr. Mohlman as editor of Sewage Works Journal. At present Chicago is the preferred location for the 1939 meeting—the final decision residing with the Executive Committee.

(Adjournment.)

(1) J. B. Estabrook, Cons. Engr., Minneapolis, Minn., and Ralph N. Palmer, City Constr. Engr., Duluth, Minn.; (2) L. F. Pfeiler, Mech. Engr., R. W. Peterson, Asst. Plant Supt., and J. I. Smith, Chemist, Sanitary District of Chicago; (3) John Norgaard, Supt. of Water and Sewerage, and John McRae, Chemist, Escanaba, Mich.; (4) Edw. Baillie, Chemist, and P. L. Koch, Biologist, Sewage Treatment Works, Madison, Wisc.

ANOTHER SEWAGE PLANT EXPLOSION

Excerpts from a Report on the Dayton Explosion

By M. W. TATLOCK
Supt., Treatment Works,
Dayton, Ohio

ON Saturday, Nov. 12, at 5:20 A. M., an explosion occurred in the pipe gallery located between the two batteries of Imhoff tanks of the Dayton Sewage Treatment Plant. This gallery housed the sludge lines, water lines, lines of the gas collection system. It was connected at both ends to control houses, in which were motor operated equipment and various control devices.

The explosion completely demolished the reinforced concrete influent and effluent conduits, which overhung the pipe gallery at both sides. The concrete slab which covered the gallery as a roof, and was used as a walkaway, was destroyed or turned over into the tanks, as pictured. The side walls of the two control housese were blown outward, allowing the concrete roof to fall on the control equipment and damage it badly. In addition to damage to the long gallery and the two control houses, windows and roof-tiles were broken by concussion and falling debris. As far as has been determined, no serious damage was done to the Imhoff tanks proper. Evidence of the terrific force of the explosion is found in the fact that sections of the gallery roof slab as large as 12 feet by 150 feet, and 8 inches thick, were dropped 60 to 75 feet away.

Probable Cause of Explosion

After detailed inspection of the wreckage by representatives of the firm of Metcalf and Eddy, designers of the plant, and by local and state officials, certain theories were advanced as to the origin and cause of the explosion. However, due to the severe damage done, the source of the leaking gas and the cause of ignition remains somewhat speculative. Certain possibilities presented themselves upon examination, and these centered around the gas pipes, pipe joints and water seals, as possible sources of leaking gas.

By process of elimination it is believed that the gas line U-tube slurry traps were most likely points of escaping gas. As originally designed and built, a series of water safeguards was installed on the gas domes to relieve gas pressure in excess of 18 inches of water. This system was changed after construction (due to certain operating handicaps), so that a maximum pressure of 21 inches might accumulate under the gas domes. In addition to these gas dome seals, a U-tube slurry trap, with

Looking Down between Two Rows of Dayton's Imhoff Tanks

A Bit of Evidence of the Power of Sludge Gas

a 30-inch water seal, was installed inside the pipe gallery ahead of the main water-seal on each gas collection line. It would have been possible for one of the gas dome 21-inch seals outside the gallery to have become clogged, creating sufficient pressure to be built up under the dome to blow the 30-inch seal in the U-tube slurry trap in the pipe gallery. Practically all of the interior U-tube traps and water seals were broken by the explosion and the damage was so severe that their examination revealed nothing of definite value.

As to the source of the ignition, the movement of the explosion along the gallery indicated that the spark came either from arcing of a loose electric bulb in the lighting system of the gallery or sparking of one of the single-phase motors operating in conjunction with the experimental high-rate trickling filter located in the gallery. Most weight is put on the theory that the origin was at one of these motors, because the wreckage seemed to indicate full force from this direction. Although some contradictions arise as to the origin of the blast, the above seems to be the most plausible reasoning, all things considered.

Only two statements can definitely be made: (1) that the explosion originated somewhere within the pipe gallery proper, rather than at any point outside of it; (2) that the explosion was caused by the ignition of released sludge gas which had accumulated in the pipe gallery through some failure, in part, of the gas collecting system.

Reconstruction, which is being rushed by city and W.P.A. workmen, is to provide improved ventilation of the gallery, and elimination of all possible sources of ignition. A new control house is to be built well apart from the Imhoff tanks.

ON WRENCHES—LONG AND SHORT

By W. F. SCHAPHORST, M.E.
Newark, N. J.

Several times I have seen workmen make a wrench longer by slipping a piece of pipe over the handle. It is a very simple procedure and it may look and sound good to some operators, but is it a smart practice to make a wrench longer in order to put nuts on tighter? If you believe it is—read on.

As you doubtless have observed, wrenches for small nuts are invariably short; for medium nuts, medium in length; and for large nuts, they are long. The manufacturers therefore seem to have some "system" in making wrench lengths, and they have. The pitch of the thread is considered, the cross-sectional area of the bolt at the bottom of the threads is considered, and the strength of the average man who does the tightening is also considered.

To make a wrench handle "twice as long" you therefore increase the tension on the bolts to twice the amount, assuming the force of pull on the wrench the same in both instances. By increasing wrench lengths, I have actually "stretched" bolts until they broke in two, or I stopped turning as soon as I felt the bolt begin to stretch. But the latter is definitely poor practice, and I do not do it any more. I do not increase the wrench's length any more because I realize that the elastic limit of a bolt should never be reached.

If you feel like making a wrench longer for "unscrewing" a nut with less effort—all right. But don't make it longer for tightening! You may, thereby, ruin a valuable piece of equipment, or may even be the cause of a serious accident.

[We hope that maybe some folks who put long handle wrenches on valve and hydrant stems, or coupling and flange bolts, will get a chance to read this and realize why threads get stripped or stems get twisted off.—ED.]

▼

HOW COPPER SULPHATE IS MADE

(In Fact)

Mr. Eugene Fitzpatrick, chief chemist of the Nichols Copper Co., read a paper on "The Manufacture of Copper Sulphate" before the New England Water Works Association. In the account of it (page 1071, November issue) our reporter comes in for some criticism by the author, who "hopes that nobody will gather the impression that his knowledge of the process is as limited as the report indicates."

Mr. Fitzpatrick points out that the 20 per cent Sulphuric Acid does *not* form a coating of copper oxide on the copper pellets sprayed with it. Circulated air forms the oxide film, and the intermittent spray of acid (every two minutes) dissolves the film. The cycle repeats automatically until the solution (at 180 degrees F.) has spent its acid and is high enough in copper sulphate to produce crystals of it upon cooling.

Mr. Fitzpatrick states also that "Snow" Copper Sulphate is produced from the above solution by rapid chilling, whereas, "Monohydrate" Copper Sulphate ($CuSO_4:H_2O$) is entirely different. The latter is produced from coarse crystals which are finely ground in a heated mill to expel all but one molecule of water, hence its name.

The Editor's Comments

THERE MUST BE A SANTA CLAUS!

A YEAR ago on this page of our pre-Christmas number we carried an open letter. It was addressed to "Dear Santa Claus." In it we asked for "a few things" which we believed would benefit the majority of our readers and the water works and sewerage profession at large. Then, we wondered if there really was a Santa Claus, and how many of those things asked and hoped for would really come to pass before another Santa Claus time would roll around. Now we believe there really must be a Santa Claus, because of the number of things asked for which have during the past twelve months come to pass.

It is not usual that Santa Claus brings even the "goodest" little boys everything asked for. And, neither did *our* Santa Claus arrange everything as we had asked for it; but, he did a very splendid job in the way of seeing that *most* of the things hoped for materialized during the year. What some of these things asked for were, and how well Santa Claus filled the order, can now be looked upon with considerable satisfaction and gratitude.

In its growth and increasing usefulness during 1937, under the leadership of the two-fisted Virginian—Gene Dugger—and its energizing Secretary—Harry Jordan—the American Water Works Association hit a real stride in 1937. And in 1938, under another keen executive—President Reeves Newsom, with Harry Jordan in the driver's seat and with members' shoulders to the wheels, A.W.W.A. has continued to go places. Amongst the accomplishments may be cited such matters as the completion and publication of standard Specifications on the Laying of Cast-Iron Pipe, and Gate-Valve Specifications (after some years of controversy); the completion of "A Manual of Water Works Accounting," produced and published jointly with the Municipal Finance Officers' Association; publication of the final report of the Committee on Activated Carbon Specifications. Fire Hydrant Specifications have been put in final shape for review and approval by the Board of Directors in January. Manuscript for the "Water Purification Manual" is in the hands of the printers.

During the year A.W.W.A. has started to work on a much needed revision of service meter specifications. It has established the less costly Affiliate membership, to reach greater numbers of operators from small communities and those in the lower salaried positions; and the Junior membership, for students and the younger men in operating positions. It has developed a Publicity Service, for the purpose of distributing to the Nation's press news items and informative stories which are framed to build a higher appreciation of the water works profession at large, with particular emphasis on the local water works management and employees, and what the water utility and qualified operators mean to the community. Registered attendance at the 1937 and 1938 conventions in Buffalo and New Orleans proved record breaking, and even this early A.W.W.A.'s Convention Management Committee has predicted (based on signs already indicative) that the 1939 convention at Atlantic City in June is to top all previous records by 350 in registered attendance. In our Dear Santa Claus letter of a year ago, we mentioned the record making strides in membership gains during 1937 and *hoped* for like progress in 1938. A.W.W.A. must be grateful, Dear Santa, because our hopes have been fulfilled, and up to this writing the stride has continued to the degree that 557 members have been added during the first 11½ months of the year to make a new high of 3,488 members now in A.W.W.A. More indicative yet is the fact that during the month just ended (November) the new member figure of 49 for the month is in itself a new record, being just double that for the same month of 1936. The curves of "Membership Sales" in A.W.W.A. are of the pattern of those curves that sales managers dream about, or set up as something to shoot for.

We mentioned the need for more State Sections in A.W.W.A. and hoped that the movement started might materialize. It did, and far better and more smoothly than seemed possible from the long range perspective. During the year there have been formed new Sections of A.W.W.A. in Michigan, West Virginia, Ohio and Western Pennsylvania, to more adequately serve the needs of members and prospective members in these states. Proving the wisdom of individual State Sections the new Michigan Section added better than 40 members in less than its first year of existence.

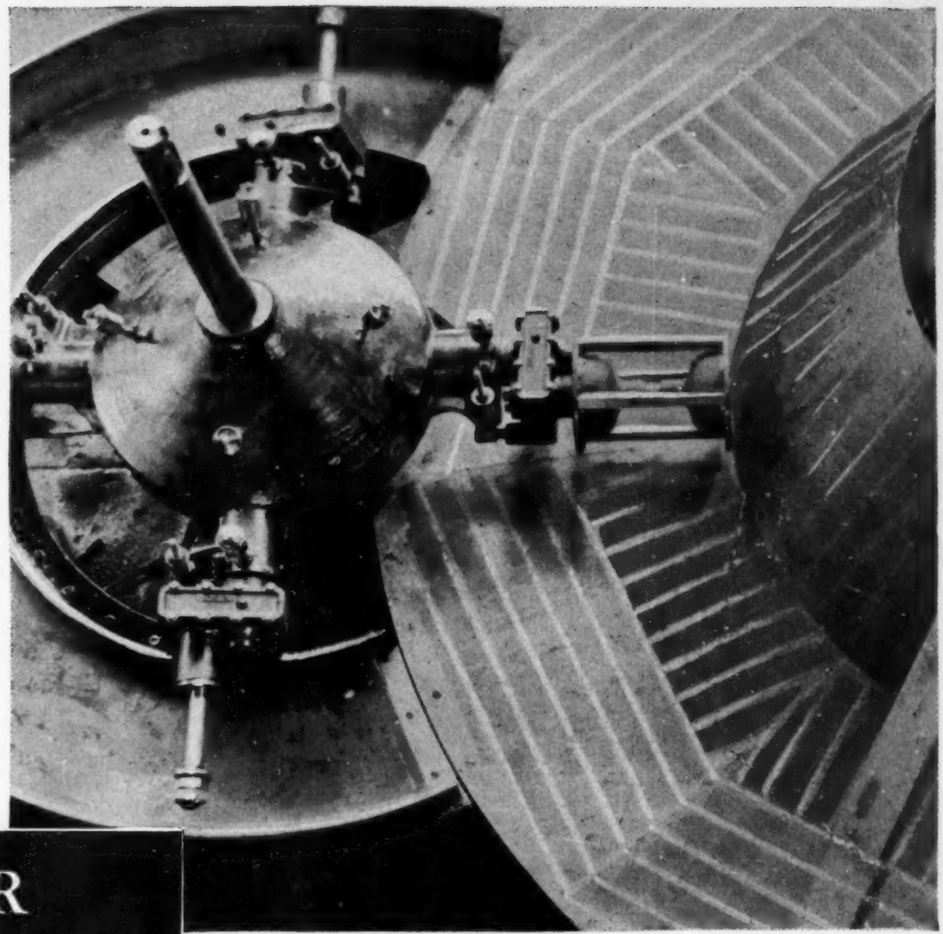
We also asked Dear Santa to do as much for sewage works associations and the sewage works man as he has done for the water works man. We are grateful, Dear Santa, to learn of the membership growth in sewage works associations, such as has been exemplified by the gains of the Central States Sewage Works Association, wherein the membership has practically doubled during the past two years under another live-wire Secretary.

As to the growth in operator licensing, our stocking did not contain as much of this as we had hoped for—considering the benefits reported from those 9 states which now have operator licensing or "certification" in one or another workable form.

In respect to the much needed Federal stream pollution control act hoped for, it was something of a keen disappointment that the President refused to sign the Vinson-Barkley Bill passed by the last Congress. However, Santa, we understand that this present was not smashed beyond recovery and that the weak spot (source of funds) will be reinforced so that it can be delivered within the year. Well, we greatly hope so, Dear Santa; but, let us thank you for the progress made by the Ohio River Valley Water Sanitation Commission in developing a compact, negotiated by eight states, and the Delaware River Basin Compact wherein four states have ratified an agreement and standards of water quality to be met in the Delaware and its tributaries.

We asked for Santa to give us more local editors who would take an interest in doing an effective job of bringing to the public's attention the worth of the local water and sewage utilities and encourage managers to become more public relations and publicity minded for their own good, and that of the employees under them. To suit us, too much of this could not have been delivered. However, we have been pleased to have had our attention directed to more local publicity of a worthy nature than in previous years and we continue to hope for and urge more of it. What may be printed during the year will be of interest to WATER WORKS AND SEWERAGE, and likewise to A.W.W.A.'s Publicity Bureau.

On the whole, Santa, it has been a good year and, with the large number of Federal aid projects under way, we look for another splendid year in 1939. We thank you sincerely.



ANACONDA
from mine to consumer

Shop assembly view of 12-foot EVERDUR sewage disc screen with revolving brush mechanism (brush staves not shown). Designed and furnished by Krajewski-Pesant Mfg. Corp., New York City, for the Stafford Springs, Conn., Sewage Treatment Works.

FOR OVER
10
YEARS

EVERDUR* has proved itself in sewage treatment service

Since 1927, for coarse and fine screens, gates, aprons, weirs, and many other sewage treatment applications, Everdur Copper-Silicon Alloy has demonstrated that it has exceptional advantages.

Steel-like strength and high resistance to corrosion are of course of first importance. But in addition, EVERDUR Metal is fabricated so easily, and is so reasonable in cost, that it is acknowledged by many authorities to be in a class by itself for sewage treatment service. EVERDUR is available in all commercial forms. Let us send you complete information. Ask for Publication E-11.

*"Everdur" is a trade-mark of The American Brass Company, registered in U. S. Pat. Off. 87388A

RUSTLESS AS COPPER
STRONG AS STEEL

Everdur Metal

THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ontario • Subsidiary of Anaconda Copper Mining Company

EQUIPMENT NEWS

A New Meter Test Bench

Experience has proved that water-meter testing substantially increases revenue, and also gives a much better picture of water actually accounted for.

Neptune Meter Co. is offering its new No. 15 Neptune Testing Bench, designed to put low-cost testing equipment well within the reach of every Water Department. It is simple and compact, designed to test accurately water meters from ⅝ to 2 inch sizes, of all types and makes. It will test at one time *two* ⅝ inch, or ⅝ x ¾ inch, or ¾ inch meters. It will test *one* 1 inch, 1½ or 2 inch meter. The assembly consists of a quickly adjustable test bench, with graduated tanks—a 1 cubic- foot and a 10 cubic-foot tank, or a 10 gallon and 100 gallon tank. All necessary fittings are included.

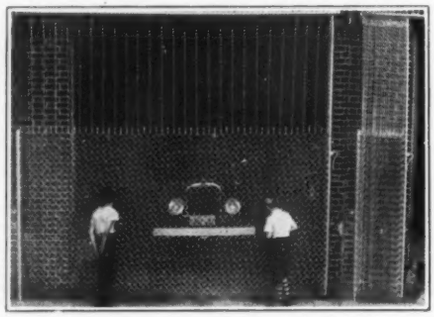
The manufacturer points to several special operating features of the new Test Bench, that make for great ease of handling and accuracy in testing. These features include glass funnels (calibrated for ¼ and 1 gallon per minute) to help regulate the flow into the small tank; protected and removable gauge glasses, with calibrated markers that can be seen from either side; wipers to clean the inside of the gauge glasses; quick-acting valves; meter-supporting table and rapid clamping device, for ease and speed of set-up and removal of meters. There is also a means of adjusting the tanks to an *exact* vertical position, thereby insuring a true reading on each gauge-glass. A plumb-line on each gauge glass serves as a constant check on the position of each tank. And, its moderate price may be said to be an additional feature.

For descriptive literature and prices write Neptune Meter Co., 50 West 50th St. (Rockefeller Center), New York City.

▼

Cornell Sliding Grille

The new Cornell Sliding Grille is nothing more than a flexible steel curtain hung from an overhead track. How compact it is when drawn back is clearly pictured above, showing the closed and open position. It is made of heavy galvanized chain link mesh; or can be supplied in aluminum or stainless steel. It comes suspended from one track, or between a top and bottom track as desired. The stock size



The Grille

is 10x12 ft., but can be supplied in any desired size on special order. The company also manufactures rolling grilles and doors.

The Cornell Sliding Grille has many uses for keeping intruders out of rooms, etc., where closed doors or windows are not desirable or necessary. They have applications in closing off switchboards, corridors, staircases; or in partitioning off storage rooms and warehouses, temporarily or permanently. For descriptive literature and prices write Cornell Iron Works, Inc., 36th Avenue and 13th Street, Long Island City, New York.

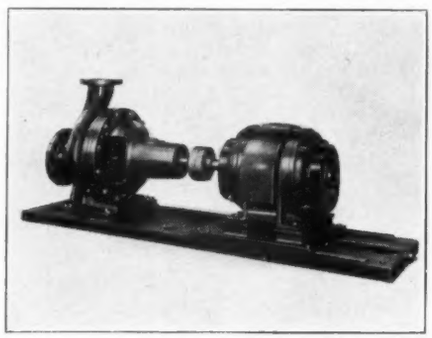
▼

Improved Open Impeller Pump

An improved design of single suction, open-vane, impeller type of centrifugal pump, has recently been introduced by the Allis-Chalmers Manufacturing Company.

This new pump is especially designed for handling liquids containing solids. All the essential and outstanding features and pumping characteristics found in Allis-Chalmers' highly successful type SSOR open runner pumps are retained in the new design. In addition, however, the new pump is so designed that its complete rotating element may be readily withdrawn from the casing without disturbing the suction and discharge piping connections, or the alignment of the pump and motor, which are mounted on a common base.

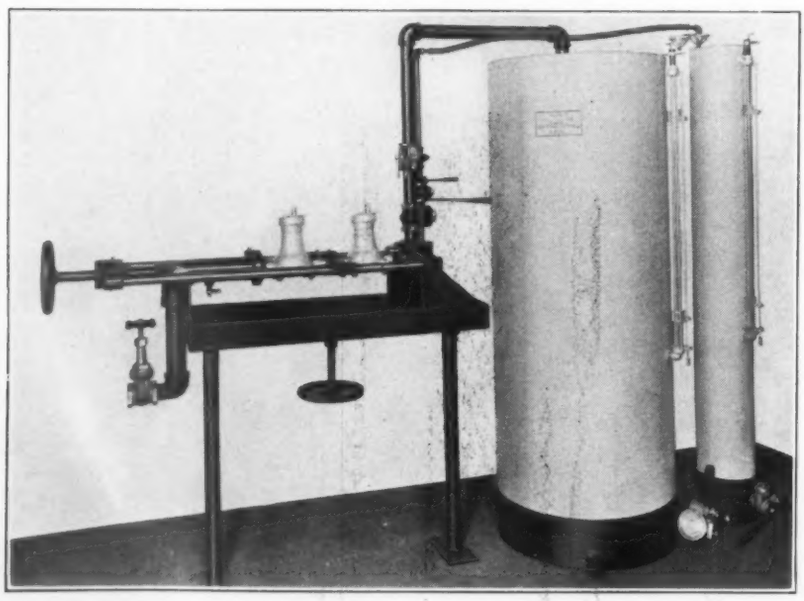
On the motor side of the pump casing, and cast integral with it, is a vertical flanged opening, large enough for the runner to go through. Rigidly bolted to this flange, and overhanging from it, is a conically shaped cast iron bearing housing containing two anti-friction bearings that support the pump shaft and its over-



New Allis-Chalmers Pump

hanging runner. The motor is mounted on an adjustable sliding sub-base which is movable by means of an acme threaded corrosion resistant screw. To remove the complete rotating element the motor can be readily drawn away from the pump a distance of about seven inches, which allows ample clearance to withdraw the runner and shaft (with the bearing housing) without disturbing any of the pump connections.

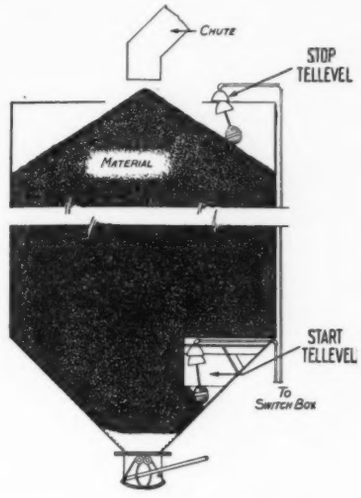
This new pump is effectively described and illustrated in Leaflet No. 2293, which may be had by request to Allis-Chalmers Mfg. Co., Milwaukee, Wis.



No. 15 Neptune Testing Bench

Automatic Storage or Liquid Level Control

The "Tellevel" is an inexpensive device, recently developed by Stephens-Adamson Co., for sounding low or high level alarms when adapted to tanks for liquids, or to storage bins for bulk materials. Or, these self-contained float switches may be employed to automatically start and stop the flow of solids or liquids into or out of storage. Or, may be employed as wired recording counters on "fill and empty" measuring systems, dosage tanks, etc. In fact, they may be used in any number of adaptations where an inexpensive float switch (self-contained type) can profitably be employed.



The "Tellevel"

The "Tellevel" consists merely of three mercury switches (in series) on the inside of the bell-shaped cast aluminum housing. From the switch housing a throw-rod extends downward to a hollow Bakelite sphere. The very simplicity and inexpensiveness of the "Tellevel" adds interest.

For a descriptitve leaflet, with quoted prices, write Stephens-Adamson Mfg. Co., Aurora, Ill.

▼

"Simplex" Automatic Wash-Rate and Flow Controller

Simplex Valve and Meter Co., have recentely perfected a fully automatic controller for water flow from any source producing a variable head on the control valve. Especially has it been found adaptable in controlling wash-water rates to filters (now installed in 3 plants) and has facilities for changing the controller rate setting from remote points. Until we saw the equipment at the St. Louis County Water Company plant (described in WATER WORKS AND SEWERAGE for November, 1938) the unit was unknown to us and is also probably "news" to others.

Basically, the unit consists of a gear driven butterfly valve within a Venturi tube or section, the opening and closing being attained with an "Ohio" torque-motor and gearing. The reversing motor runs alternately forwards and backwards to maintain constant flow under changing head conditions — whether these head changes be "fore or aft" of the Venturi section.

By electrical transmission the desired rate, when set at the flow indicating and recording instrument, is transferred from the operating gallery, the office or pump station, to the powerful torque motor at the Venturi unit. The feature of the motor is its ability to stand over-voltage and give dependable service with constant starting, stopping, and reversing.

For further details, write Simplex Valve and Meter Company, Phila., Pa.

▼

Lincoln Welder

New Welder Has Self-Indicating Control

A line of "Shield-Arc" welders, said to provide greater convenience and accuracy because of a new self-indicating dual continuous control, has been announced by The Lincoln Electric Company.

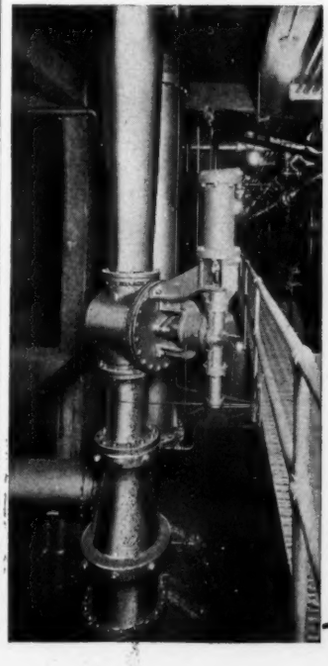
These welders have both job selector and current control calibrated and equipped with dials which indicate the type of work and the number of amperes for each and every setting, whether it be a thawing job on a main or service, or a cutting or welding job. It is claimed that this development enables the operator to secure highest quality work and speed because he can vary both the slope of the volt-ampere curve and the amount of current independently and positively to suit the job. Being continuous, the control can be advanced or retarded in increments as fine as desired.

Other features of this new welder include:

(1) A self-protected motor on all AC motor driven units. (2) Separate excitation of the generator, which in the case of the engine driven units, permits the use of an over-size exciter for operation of

Which Primary Element?

VENTURI TUBE, FLUME, WEIR, ORIFICE, OR NOZZLE



The primary element for your metering application should be selected not arbitrarily but by the requirements to be fulfilled and by the economic considerations entering into the installation.

Sewage and sludge are often, though not always, measured by Venturi Tubes, Flumes, or Weirs.

Water may be satisfactorily measured by any type of primary element. Factors such as the cost of pumping, the pressure and the size of pipe or channel usually dictate the device used.

Steam is usually measured by the Bailey Orifice or Flow Nozzle.

Bailey Meter Company holds no brief for any particular primary element, its only interest is in making sure that the user secures the highest accuracy and reliability at the lowest expense.

Detailed information on the advantages of various types of primary elements furnished on request.

MU-18

BAILEY METER COMPANY
1072 IVANHOE RD., CLEVELAND, O.
Bailey Meter Company Limited, Montreal, Canada

lights and tools at slight additional cost. (3) A laminated magnetic circuit, to quicken the response of the generator to changing conditions.

For further details request Bul. 412-A. Address, Lincoln Electric Co., Cleveland, Ohio.

▼

Improved Carbon Steel Wrenches

An improved type of Carbon Steel Wrench is being supplied by J. H. Williams & Co., in a complete line consisting of 50 patterns and more than 1,000 sizes.

These improved wrenches are approximately twice as strong as old-fashioned carbon steel wrenches, but cost no more

than old-fashioned carbon steel wrenches, and considerably less than alloy wrenches, which are only 7 per cent stronger. The manufacturers (makers of both carbon and alloy wrenches) recommend their Chrome-Molybdenum Wrenches for operation in close quarters, or where higher polishing and chrome-plating is desired.

A free booklet *"How to Select and Use Wrenches,"* which provides much useful wrench information, may be secured by writing to J. H. Williams & Co., 75 Spring Street, New York City.

▼

New Strip Heating Elements

Westinghouse announces two new types of strip heaters, designed to produce fast and economical heat. Made in two temperature ratings of 750° F. and 1200° F. on the sheath, these heaters are particularly applicable for heating chlorinator houses, crane cabs, valve houses, pipe galleries and elsewhere.

Heaters may be obtained with both terminals at one end, or at opposite ends, for installation convenience. The heating elements, with refractory insulation and sealed against moisture, are completely enclosed and bolt holes are provided at each end for quick and permanent installation.

Available for operation on 115, 230 and 250 volts (2 styles for the latter) the heaters include sizes of 8, 12, 18, 24, 30½, 36 and 43 inches in length, with ratings from 150 to 1250 watts.

▼

WITH THE MANUFACTURERS

Silver Anniversary Celebrated by W. & T.

On Sunday, November 13th, 1913 (note the "13's" for luck), Fred Wallace and Mike Tiernan, with a good reputation, no jobs and only $800 between them in hard earned savings, decided to incorporate under the name of Wallace & Tiernan Co., although they had but one lathe, a helper and an overdue rent bill on their attic shop. But, they had ideas and vision.

On November 13th, 1938, this same Fred Wallace and Mike Tiernan celebrated their 25th year of Wallace and Tiernan, Inc., in the most recent addition to their continuously growing six acre plant in Belleville, N. J. ("The Home of Wallace & Tiernan") and factories also in Canada and England.

The W. & T. Silver Jubilee Celebration took up the best part of one week. It started on Armistice Day with "open-house" and an award of spending silver to all employees and their families. Of this group (1,200) there was one man who has been continuously in the employ of the company for the full 25 year period—Joe Mancuso—the single employee at incorporation. Others had been with the company almost as long—Salvatore Sarli, being practically a 25 year man.

On the evening of Nov. 15th, Messrs. Wallace and Tiernan, as hosts, looked over a banquet room in which were seated as their guests about 250 husbands and wives, constituting business acquaintances, engineers, lawyers, judges, municipal officials, and good friends of the past 25 years. The

spacious cafeteria of the new plant addition was the banquet hall and M. F. Tiernan presided. It was a festive occasion and a wholly enjoyable affair, to hear the history of Wallace & Tiernan, Inc., unfolded by Host Tiernan. Few realized, until hearing it, that Messrs. Wallace & Tiernan tried to make ozonation successful before their pioneering work with chlorine began.

Especially interesting were the reminiscences of Judge McMahon, who as a young lawyer lived in the same boarding house with Tiernan and Wallace and, incidentally, couldn't find enough assets without putting in "good will" to make legal the incorporation of Wallace & Tiernan in 1913. He read from the original incorporation papers and added those little things on which so much has hinged during the past 25 years of Wallace & Tiernan, Inc. Tiernan said it would work and Wallace made it work. It proved a remarkable combination of business acumen and scientific ability.

The inimitable Willard Chevalier, principal speaker of the occasion, spoke on "Business Opportunities 25 Years ago—and Today"—of the material of which Wallace and Tiernan are made.

At every guest's place was found the Silver Anniversary Medallion here pictured—a souvenir of a celebration which "The Romance of Chlorination" made possible.

▼

"SKINNER-SEAL" Becomes Trade-Mark

K. G. Merrill

M. B. Skinner Company of South Bend, Indiana, makers of repair clamps for steel and cast iron pipe, has announced that the U. S. Patent Office has just issued Trade Mark No. 359892, which protects the trade name "SKINNER-SEAL" used in connection with Skinner products.

Although the trade name "SKINNER-SEAL" is new, the Skinner pipe repair method was introduced in 1898, and Skinner Clamps in a variety of styles have been widely used since that time in the water works and industrial fields.

(This announcement has come from K. G. Merrill, president of the company.)

▼

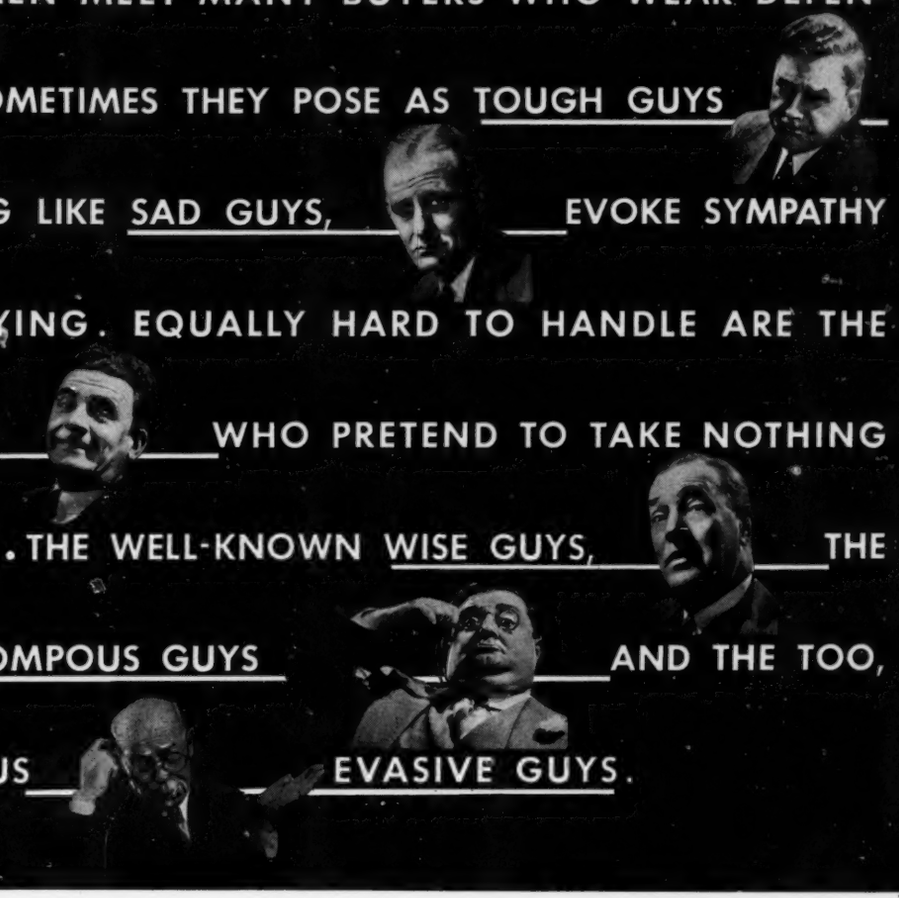
J.-M.'s California Transite Plant Starts Production

The new million dollar Johns-Manville plant in Watson, Calif. (Los Angeles suburb), has started production of "Transite" pipes of all classifications and sizes required for water mains, purification plants and sewer systems. In addition, this plant produces "Transite" electrical conduit, vents and stacks.

"Transite" is J.-M.'s trade name for asbestos bonded (reinforced) high density cement pipe, first developed in Italy, and now used abroad for about 30 years. In America it was first produced at the Waukegan, Ill., plant of Johns-Manville in 1928. The second "Transite" plant was built at Manville, N. J., to serve the East; and, now the plant at Watson, Calif., is to serve the West Coast territory. It will produce pipes from 2 to 36 inches in diameter for pressures of zero (sewer systems), 50, 100, 150 and 200 lbs./sq. in. Each length of pipe is given thorough hydrostatic head tests. In addition, the beam-test for flexibility is applied where pipe flexure may be a possibility after installation.

HARD GUYS TO SELL . . .

THESE PROSPECTS OF YOURS



YOUR SALESMEN MEET MANY BUYERS WHO WEAR DEFENSIVE MASKS. SOMETIMES THEY POSE AS TOUGH GUYS — OTHERS, ACTING LIKE SAD GUYS, — EVOKE SYMPATHY TO AVOID BUYING. EQUALLY HARD TO HANDLE ARE THE FUNNY GUYS — WHO PRETEND TO TAKE NOTHING SERIOUSLY . . . . THE WELL-KNOWN WISE GUYS, — THE "PUFFED-UP" POMPOUS GUYS — AND THE TOO, TOO NUMEROUS — EVASIVE GUYS.

DEVIOUS are their defensive ways, these hard-to-sell prospects of yours. But there is one thing these buyers have in common. They drop their defensive attitudes when they pick up *Water Works and Sewerage* to get progressive ideas and the news of the waterworks and sewerage fields. And just as they are receptive to the counsel of editors in whom they have confidence, they are receptive to profit-making ideas suggested through the advertising pages. Your advertising in *Water Works and Sewerage* will reach your hard-to-sell prospects while they are "themselves". It will help your salesmen to get back of those masks of sales resistance.

Highest editorial standards and publishing integrity.

WATER WORKS AND SEWERAGE

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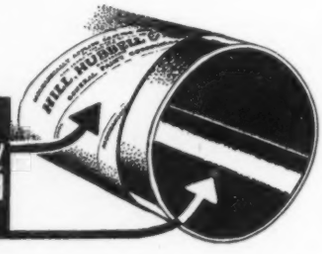

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MEETINGS SCHEDULED:

Dec. 15—Boston, Mass. (Statler Hotel)
New England Water Works Association. (Monthly Meeting.) Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Dec. 29—New York City, N. Y. (Pennsylvania Hotel)
New York Section A.W.W.A. ("Get-together" Luncheon Meeting, 12:30 P. M.) Sec'y, R. K. Blanchard, 50 West 50th St., New York City.

Jan. 16-20—Stillwater, Okla. (A. & M. College)
Oklahoma Water and Sewage Conference. 15th Annual Short Course. Sec'y, H. J. Darcey, State Sanitary Engr., Oklahoma City; Director of Short Course, Prof. C. E. Perkins, A. & M. College.

Jan. 18-20—New York City, N. Y. (Eng. Soc. Bldg.)
American Society Civil Engineers. Sec'y, Geo. T. Seabury, 33 West 39th St., New York City.
(Jan. 19—Sessions and Joint Dinner of the Sanitary Engineering Division and N. Y. State Sewage Works Ass'n.)

Jan. 19-21—New York City, N. Y. (Hotel McAlpin)
New York State Sewage Works Ass'n. Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 19—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 21—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Jan. 19—Boston, Mass. (Statler Hotel)
New England Water Works Association. (Monthly Meeting.) Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Feb. 7—New Brunswick, N. J.
New Jersey Section A.W.W.A. Sec'y, Prof. H. N. Lendall, Rutgers University, New Brunswick, N. Y.

Mar. 9-10—Trenton, N. J. (Stacy-Trent)
New Jersey Sewage Works Association. (24th Annual Meeting.) Sec'y, John R. Downes, Supt. Sewage Treatment Works, Bound Brook, N. J.

Apr. 10-12—Memphis, Tenn.
Kentucky-Tennessee Section A.W.W.A. (Tentative.) Sec'y-Treas., H. D. Schmidt, State Dept. Health, Nashville, Tenn.

Apr. 12-14—Toronto, Ont. (Royal York Hotel)
Canadian Section A.W.W.A. Sec'y-Treas., A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

Apr. 17-19—
Southeastern Section A.W.W.A. Sec'y-Treas., B. P. Rice, State Board of Health, 422 State Office Bldg., Columbia, S. C.

Apr. 25-26—Indianapolis, Ind.
Indiana Section A.W.W.A. Sec'y-Treas., J. A. Bruhn, Indianapolis Water Company, 113 Monument Circle, Indianapolis, Ind.

Apr. 27-28—Dayton, Ohio
Ohio Section A.W.W.A. Sec'y-Treas., T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 18-20—Tacoma, Wash.
Pacific Northwest Section A.W.W.A. Sec'y-Treas., Fred Merryfield, Assoc. Prof. San. Eng., Oregon State College, Corvallis, Oregon.

June 11-15—Atlantic City, N. J. (Hotels Ambassador and and Chelsea—Registration, Meetings, Exhibits in Auditorium)
American Water Works Association. (59th Annual Convention.) Sec'y, Harry E. Jordan, 22 East 40th St., New York City.

June 28-30—State College, Pa. (Nittany Lion Inn and Dormitories)
Pennsylvania Water Works Operators' Association. Sec'y-Treas., I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

CATALOGS AND LITERATURE RECEIVED

[Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.]

"I-R Diesel Catalog"—A new and very complete forty-page bulletin on Type "S" Diesel Engines has just been published by Ingersoll-Rand. This type is a heavy-duty engine, for continuous-service such as is required in water works service. Its low fuel consumption of only 0.38 lbs. per BHP Hr., at full load, is emphasized. The fuel injection system has an individual oil pump for each cylinder and there are two single-acting non-clogging nozzles per cylinder.

The Type "S" is a four-cycle, single-acting, solid-injection engine, having complete force-feed lubrication. It is available in 3, 4, 5, 6, 7 and 8 cylinders, and rated 175, 230, 290, 350, 405 and 460 BHP., respectively, at 600 revolutions per minute. Specifications, dimensions, cut-away views, and water works installation pictures, are contained in the catalog (form 10110), copies of which are obtainable from the Ingersoll-Rand Company, 11 Broadway, New York City.

"Arrowhead Gratings and Treads"—are presented in a new catalog, most attractively illustrated to reveal the variety of uses and symmetrical beauty of "Arrowhead" Gratings and Stair Treads. Several of the installation pictures are of water and sewage and other municipal utility plants. The basic design, for strength, cleanliness, light admission, and symmetry—all obtained in the arrowhead pattern—is discussed. Tabular data and detailed illustrations reveal types required for various adaptations, showing weights and safe loading specifications. It is especially interesting to note the progress made by this company since the appearance of earlier catalogs. For a copy of their new catalog, write Arrowhead Iron Works, Inc., 421-31 West 5th Street, Kansas City, Mo.

"Meterization from Coast to Coast"—might have been the title of a most attractive 32-page brochure, just produced by Neptune Meter Co. The production will especially interest water works managers and department heads, because it comprises a series of expertly illustrated articles by leading water works managers and engineers from coast to coast. Naturally, the gist of the articles pertains to metering experiences of these leading authorities, and the stories are worth the reading for their interest and the attractive illustrations. The title of this bit of technical appraisal (and work of artistry combined) is taken from Shakespeare—"More Water Glideth by the Mill than Wots the Miller." For a copy, write Neptune Meter Co., 50 West 50th St., New York City.

"REX Screw Conveyors and Elevators" are presented in a catalog fresh from the press, and just received from Chain Belt Co. It covers in a very complete manner REX Screw Conveyors, Bucket Elevators and parts for each. Capacity charts, pointers in the selection of screw conveyors, and full specifications, accompany the many illustrations. For Catalog 334 write Chain Belt Co., Milwaukee, Wisc.

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Magnetite Filters remove 40 to 50% of the suspended solids which failed to settle in the primary sedimentation tanks.

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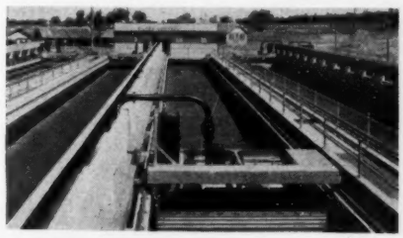

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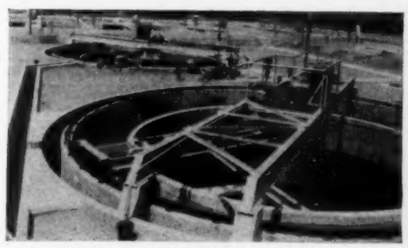

Greece, N. Y.

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Cleveland, O.

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"Defluorite"—is the trade name for the specially prepared, highly adsorptive tri-calcium phosphate, which has marked affinity for fluorine ions. This material and the method of adaptation in water treatment, for removal of the damaging and disfiguring fluorides from potable waters, is the subject of a new bulletin from International Filter Company. On another page of this same issue is a report covering the damage to health and personal appearance of individuals who must consume waters containing more than 1 p.p.m. of fluorine. Fluorosis is more widespread than is appreciated by many—as indicated by the spot map in the bulletin. The new brochure presents something of the history and effects of fluorosis, and means of removing fluorides from water.

The closing paragraphs describe the properties of "Defluorite" and its capacity for fluoride ion, when water passes through contact beds of the material. Regeneration is effected with dilute caustic soda solution followed by rinsing and, thereafter, bleeding in carbon dioxide gas to convert the residual hydrate to bicarbonate. From all that can be learned, the calcium phosphate method (alone or following softening) is the best available solution of the fluoride problem—so engineers will find "Defluorite" (Bul. 2500) a valuable source of information. For a copy, write International Filter Co., 59 East Van Buren St., Chicago.

"The Everson Safety Sterilizer"—Is presented in a new eight page bulletin from Everson Mfg. Co. of Chicago, whose slogan is "Everything for the Swimming Pool." The Everson Safety Sterilizer produces sodium hypochlorite solution, continuously, by passing electric current through a water solution of salt. It is particularly designed for use in sterilizing swimming-pools, where liquid chlorine may constitute a hazard in such places as public school-buildings, Y.M.C.A.'s, or hotels. The new bulletin thoroughly describes the electrolytic sterilizer and explains its installation, operation and maintenance. Operating costs are stated to be between 10 and 15 cents per day for the average pool. Reasons for preferring hypochlorites to chlorine gas in swimming pool chlorination are cited in the bulletin and numerous typical installations are pictured. For a copy of Bulletin 1000, write Everson Mfg. Co., 214 West Huron St., Chicago, Ill.

"New Lighting Handbook." Rapid advances have been made in the art and science of lighting during the past two years. To provide a ready source of up-to-the-minute "lighting facts," Westinghouse Electric & Mfg. Co. have just produced a new edition of its lighting handbook. Titled "Artificial Light and Its Applications," the new 258 page edition is larger and much more comprehensive than earlier issues, there being 12 added chapters. Tables have been revised and the text has been simplified and profusely illustrated. The new edition has value to the experienced engineer for reference; to the beginner as a textbook. Copies may be obtained from any Westinghouse district or branch office, or Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

[To partly defray the cost of production and to prevent wasteful requests, a charge of 75 cents per copy is being made for this 258 page, 8½ by 11 inch production.]

AN ANSWER TO THE QUESTION:
"WHAT IS THE MEANING OF pH?"

pH *And Its* Practical Application

By Frank L. LaMotte, William R. Kenny, Allen B. Reed

TABLE OF CONTENTS

Section A. Mechanism of Hydrogen Ion Determinations
I—Introduction and Preliminary Discussion
II—Hydrogen and Hydroxyl Ions
III—Buffer Action
IV—Determination of pH
V—Sources of Error
Section B. Practical Application of Hydrogen Ion Determinations in Industry and Science
VI—Municipal and Industrial Water Supply
VII—Water Corrosion Problems
VIII—Disposal of Sewage and Industrial Waste
IX—Sugar Industry
X—Gelatin and Glue
XI—Leather Manufacture
XII—Textile Industry
XIII—Pulp and Paper Industry
XIV—Food Industries
XV—Cleaning Processes
XVI—Electrodeposition of Metals
XVII—General Industrial Chemistry
XVIII—Bacteriology, Pathology, and Titration Procedures
XIX—Soils

Today the term "pH" is part of the routine vocabulary of almost every technical man, and the usefulness of the subject has benefited so many processes that it is now an accepted operating factor. So rapid has been its adoption throughout the technical world, that a great many routine workers now using some means of pH control do not have a clear understanding of the term "pH" itself, nor of the simple underlying principles involved in its measurement.

It is the purpose of this book to supply the need for such fundamental information in simple language, avoiding technical terms as much as possible.

Scientific men whose early training has not included this phase of chemistry and operating men will find "pH And Its Practical Application" to be a *practical* book for any reader who is not particularly interested in the theoretical aspects of hydrogen in concentration.

The broad scope of the book is indicated by the Table of Contents.

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I should like to have "pH And Its Practical Application" on 10 days' free trial. At the end of that time I will remit $3.50 or return the book, postpaid.

"Repair Clamps and Saddles"—is the title of a new catalog from M. B. Skinner Co., which presents nine different styles of pipe repair clamps (slogan "A Clamp for Every Leak") now marketed under the trademark "Skinner-Seal." A page in the new catalog carries an interesting chart which graphically pictures the meaning and extent of loss in water waste (volume and dollars) which results from pipe line leaks of various sizes and numbers. When carried through for a year's period even the minor leaks run into astonishing computed losses in volume and net earnings. The "Leak-Loss" chart alone is worthy of request for Catalog (30 A). Address, M. B. Skinner Co., South Bend, Indiana.

"FEREC-Iron Removal Filters" — Constitutes a new development by Wm. B. Scaife & Sons Co., established manufacturers of water purification equipment since 1802. These novel filters have been designed to remove iron from water by a new process known as "catalytic filtration." Regardless of whether the iron is in solution or suspension, or whether in the ferrous or ferric state, the contact bed of "FEREC" removes it effectively. No regenerating of the bed is required—the hard granular material (about 0.55 m.m. effective size) requiring nothing more than backwashing which any ordinary sand filter requires. At filtering rates up to 4 gals./sq. ft./min. an effluent of less than 0.2 p.p.m. residual iron is guaranteed from a 30 inch bed of "FEREC." For this interesting new technical bulletin (No. 299) write Wm. B. Scaife & Sons Co., Oakmont (Pittsburgh District), Pennsylvania.

"Lock Joint Pipe"—is an impressive production by Lock Joint Pipe Company. It brings together much information of worth to engineers and contractors pertaining to the merits of Reinforced Concrete Pipe equipped with the highly perfected "Lock-Joint"—wherein every joint becomes a tight but flexible expansion joint. Permanency and sustained carrying capacity is the claim for supremacy of such pipes. An impressive listing of important pipe lines constructed of "Lock-Joint" pipes, with pertinent data and leakage records, tells pretty much its own story. Details of construction, and specifications covering the pipe and joint, together with methods of tapping these concrete jacketed steel-cylinder reinforced pipes are given and illustrated. Interesting are the pictured installations through rock-ledge, mangrove swamps and desert. For a copy, write Lock Joint Pipe Co., Ampere, N. J.

"The Comminutor"—presented in 1938 style, is the subject of a fresh bulletin from Chicago Pump Company. This production comes up to the customary standards of literature distributed by the "Comminutor" makers. It presents attractive installation pictures, detailed design, features, and specifications. On the back cover an impressive listing of 311 units in use at 219 plants (to Sept. 1st, 1938) reveals also the engineers on the several projects. It's a veritable list of "Who's Who" amongst sanitary engineers. And to those unfamiliar with "Comminutors" we will say that it's "The Service Which Took the Drudgery out of Screenings Disposal." For a copy of this garnet and silver bulletin No. 185, write Chicago Pump Co., 2300 Wolfram St., Chicago.

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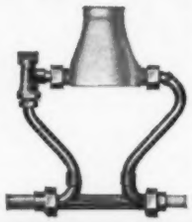

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"Permutit De-Gasifiers"—are slat filled towers through which water splashes, films out and breaks up repeatedly in its staggered course from top to bottom. A bulletin from Permutit Company describes and illustrates these units, their operation, and their effectiveness as aeration or as degassifying units, functioning also under partial vacuum where desired.

"Zeo-Karb" (Permutit Bulletin No. 2118) is devoted to an explanation of the principles upon which the new carbon-zeolite functions to remove base ions (including sodium) and substituting the hydrion of acids—hence the name Hydrogen Zeolite. Some interesting comparisons in total solids removal by lime-soda or ordinary zeolite, as compared to results with hydrogen zeolite, are graphically presented. Some typical performances and applications are illustrated, as in the modern hook-up of sodium and hydrogen Zeolite units, to produce a product approaching distilled water. For copies of either or both bulletins, write The Permutit Company, 330 West 42nd Street, New York City.

"Wood Pipe Handbook." From National Tank and Pipe Co., has been received the new 1938 edition of their "Wood Pipe Handbook" of 265 pages, 4½ by 7 inches, in red simulated morocco binding. The subject matter ranges from an authoritative 95 page section on hydraulics and pipe line design, to a description of the manufacture and applications of wood-stave pipe. Especially valuable is the section in which examples of problems encountered by engineers are solved both scientifically and through the use of flow tables prepared especially for the handbook. Many tables of conversion factors, functions of numbers, and the like, appear in the appendix. It is a handy and useful little handbook. For a copy write National Tank and Pipe Company, Kenton Sta., Portland, Oregon.

"Crane Research"—is the subject of an impressive 47-page brochure which tells the reader, by word and illustration, how Crane Company Laboratories are equipped and what Crane scientists are doing in an endeavor to produce new products and to better old line products. Under the heading "Sanitation and Hydraulics" much weight is being given to perfecting non back-syphoning fixtures. In the research laboratories 285 persons are employed and the use of the X-ray is a decided aid to more perfect metallurgical production. Not the least interesting is the Works Laboratory which exercises "everyday" control over production of all Crane products. This booklet was produced as a souvenir of "Open House" recently held by Crane's Research and Engineering Department at the Chicago Works of the company.

"Solenoid Valve Catalog—1938" — Has recently been issued by Automatic Switch Co. of New York, to replace their 1936 issues. The new catalog covers the complete line of "ASCO" Solenoid Operated Valves, plus the full line of automatic controlling devices. An interesting feature of the catalog are the "General Service Recommendations," in chart form for easy reference and location of the type of value needed for each given service condition. For use where indicated, explosion proof solenoids are also now available. Some "do's and don't's" in making solenoid valve installations are given, for the benefit of designers and contractors. There are also "pointers" in operation and maintenance. Specifications covering various valves are accompanied by pictures of the valve described. For a copy of "Asco Valves—1938" write Automatic Switch Co., 154 Grand St., New York City.

"Waterplugging"—is described in a folder from Standard Dry Wall Products, Inc. "Waterplug" is employed to stop water leaks through concrete or masonry walls, whether the leak be a spurting stream or slow seepage. The material is a quick (3 to 5 min.) setting and permanently water tight cement. The procedure calls for adding water to make a "putty-ball" of desired size; slap it into the leak, and hold the palm of the hand or board against it for 3 to 5 minutes, and the job is done. It is also recommended as a bolt or rod anchoring material, and for other uses where such a cement-putty has value. The "plug" is said to have remarkable ability to stop leaks even under extreme heads.

"Quickseal" is another waterproofing cement; in this instance a slow setting cement applied as a slurry by brushing, or a wet mortar for trowelling onto masonry walls. It forms a perfect bond to dry, damp, or wet surfaces. For descriptive literature on "Waterplug" and "Quickseal," write Standard Dry Wall Products, Inc., West Elizabeth, Penna.

"Infilco Rotary Distributors and Automatic Dosing Siphons"—are described and illustrated in a new bulletin from International Filter Co. Along with detailed descriptions, this bulletin contains views of typical installations and drawings illustrating special features of both the distributors and automatic siphons. Such features include the mercury seal which prevents loss of sewage and assures trouble-free operation during freezing temperatures. In addition, there is a bronze seal ring which acts as a baffle in protecting the mercury seal-ring from excessive heads, and prevents sewage solids from entering the mercury seal. An annular catch reservoir, with provision for automatic mercury return, is an important feature of the seal.

Nickel-iron, used in the distributor castings, affords greater protection against corrosion and provides added tensile strength. Thus are permitted larger areas in the ports of the stationary diffuser, with a consequent reduction in head loss. Design making for ease in draining and flushing is also stressed. For a copy of Bul. No. 2410-A, write International Filter Co., 59 East Van Buren St., Chicago.

"Caterpillar Diesel Tractors" are minutely described with profuse illustrated detail in a new 33 page booklet from Caterpillar Tractor Co., of Peoria, Ill. The engine, fuel system, transmission and final drive are illustrated in two color cut-away views, to indicate fuel and lubricating oil circuits, fuel pumps and filters, air cleaners, etc. Stressed is the heavy-duty transmission and dust tight final drive, built for "positive pull." Form 4876 can be had from Caterpillar Tractor Co., Peoria, Ill.

"Wood Tank Catalog." Also from National Tank and Pipe Co. has come a new Wood Tank catalog describing tank installations of a wide variety. It pictures how wood tanks and their foundations are designed and erected. Illustrations make quite clear many features of tank construction not usually published. For "Wood Tank Catalog No. 37" write National Tank and Pipe Co., Kenton Sta., Portland Oregon.

"Can You Work Under Pressure?"—is the title of a colorful folder which illustrates how it is possible to make main repairs and cut-ins, under pressure, with Mueller Tapping Sleeves and Valves. If interested in this matter write Mueller Company at Decatur, Ill., or Chattanooga, Tenn., for their pink and green folder telling "How to Work Under Pressure."

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Many Advantages

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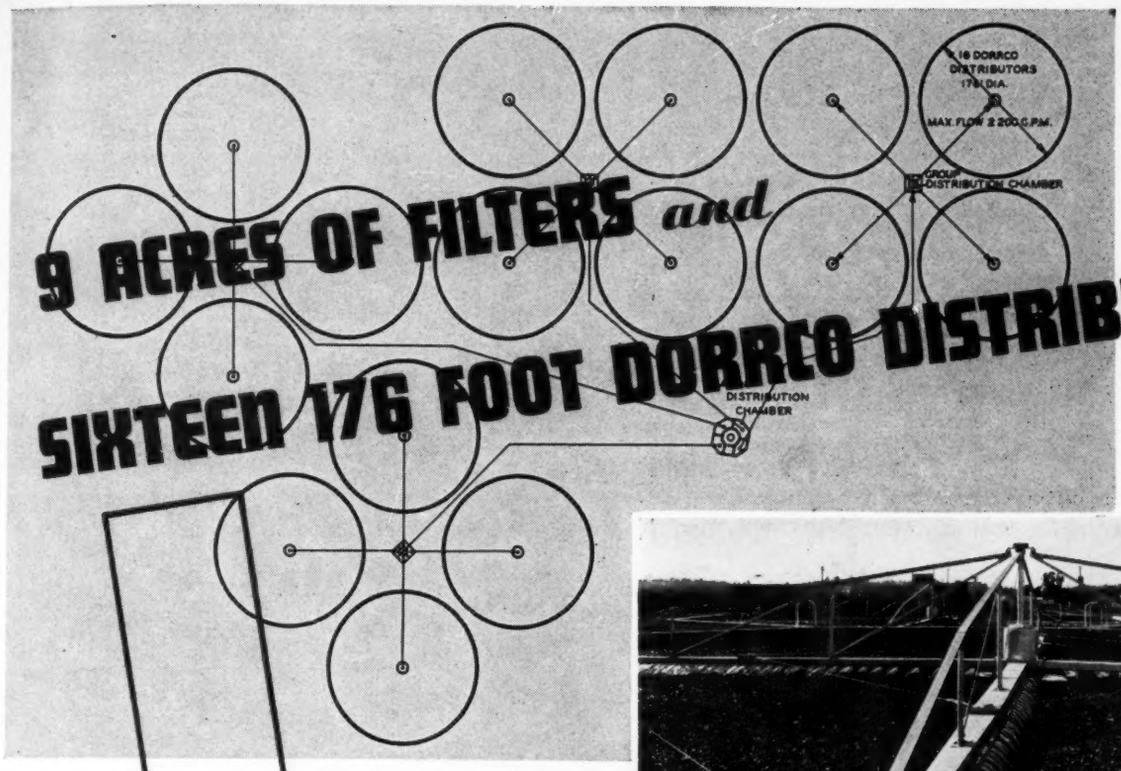

9 ACRES OF FILTERS *and* SIXTEEN 176 FOOT DORRCO DISTRIBUTORS

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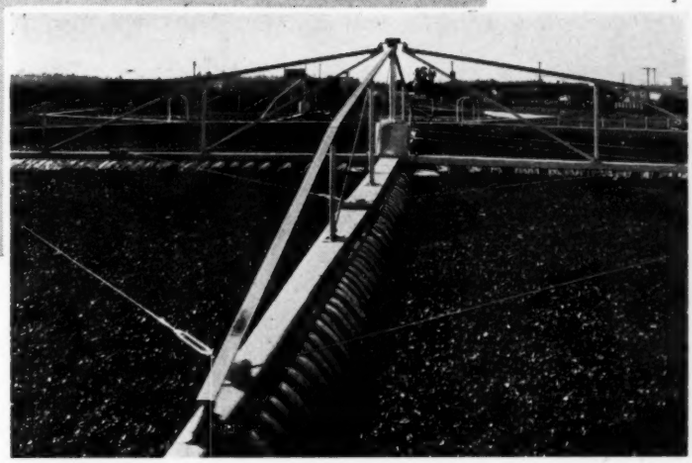

Modern 75' diameter Dorrco Distributor at Petaluma, Calif.

DATA ON DALLAS DISTRIBUTORS

No. of Distributors	16
Diameter	176'
Arms per Distributor	4
Max. Flow—per unit	2,200 g.p.m.
—total	50 m.g.d.
Area of Beds	
—per unit	24,328 sq. ft.
—total	8.93 acres
Layout—see diagram above.	

ONE of the largest rotary distributor installations in the United States—sixteen 176' diameter Dorrco Distributors—will soon be erected at Dallas, Texas.

These sixteen units, plus a Dorr Multdigestion System, are being added to existing equipment at Dallas to provide complete treatment for a maximum flow of 50 million gallons per day.

Dorrco Distributors now in operation, or on order, in the United States are treating a combined average flow of 153 million gallons of sewage per day. These units range in size from the largest—two 200 ft. Dorrco Distributors for Visalia, California—to the smallest, a unit of only 10 ft. diameter. The cumulative knowledge and experience gained from the building of this large number of units has produced the new and improved Type KC design ordered for Dallas.

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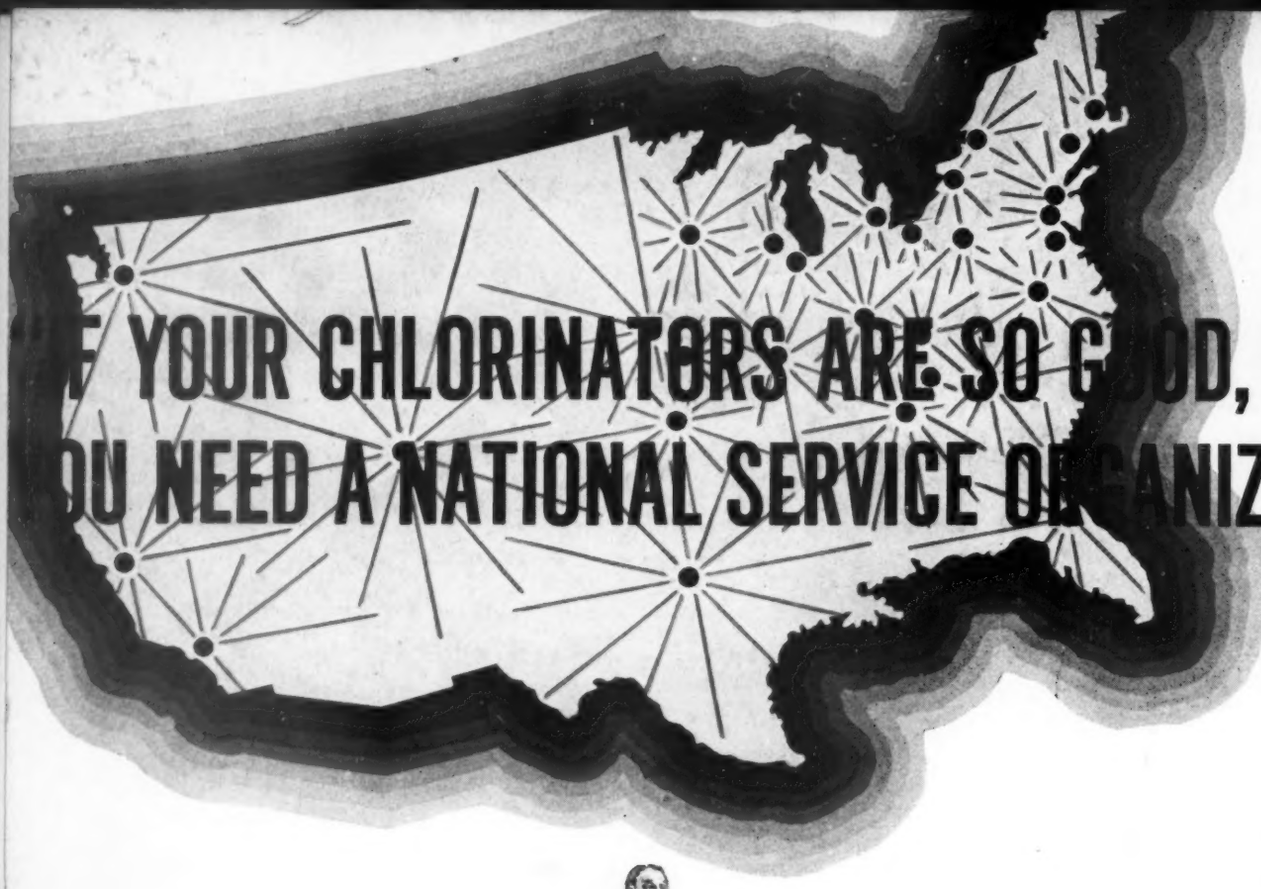

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W&T Visible Vacuum Chlorinators are good chlorinators. They are designed by competent engineers, thoroughly experienced in the correct application of chlorination under all sorts of conditions. They are built by standardized manufacturing methods from the finest materials available. They are tested before leaving the W&T factory under the conditions which will accompany their installation in the field. They are installed under the supervision of trained W&T engineers and the operators are thoroughly instructed in the care and operation of the equipment before the W&T men leave.

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